Compress

FEBRUARY 1952

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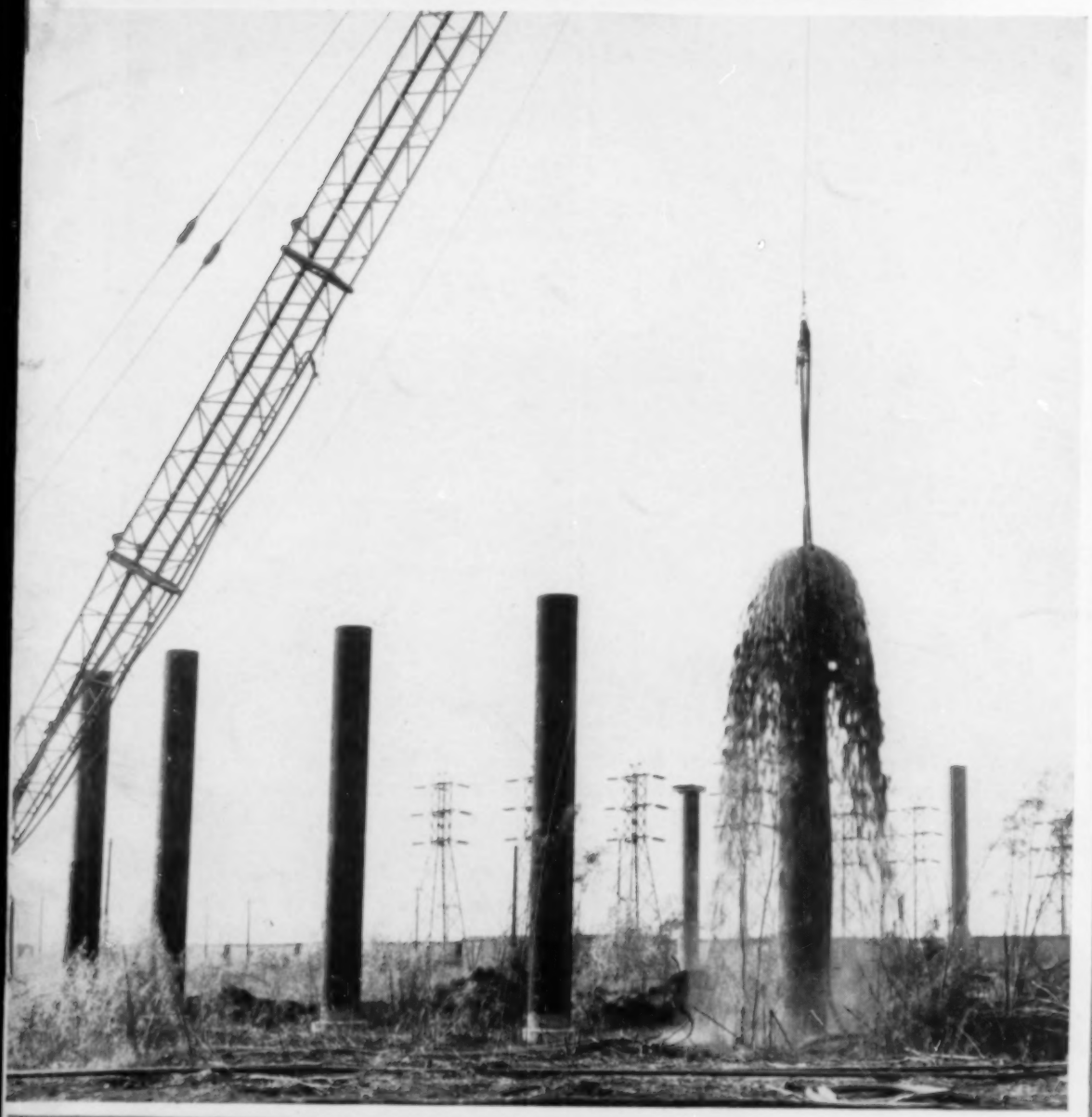


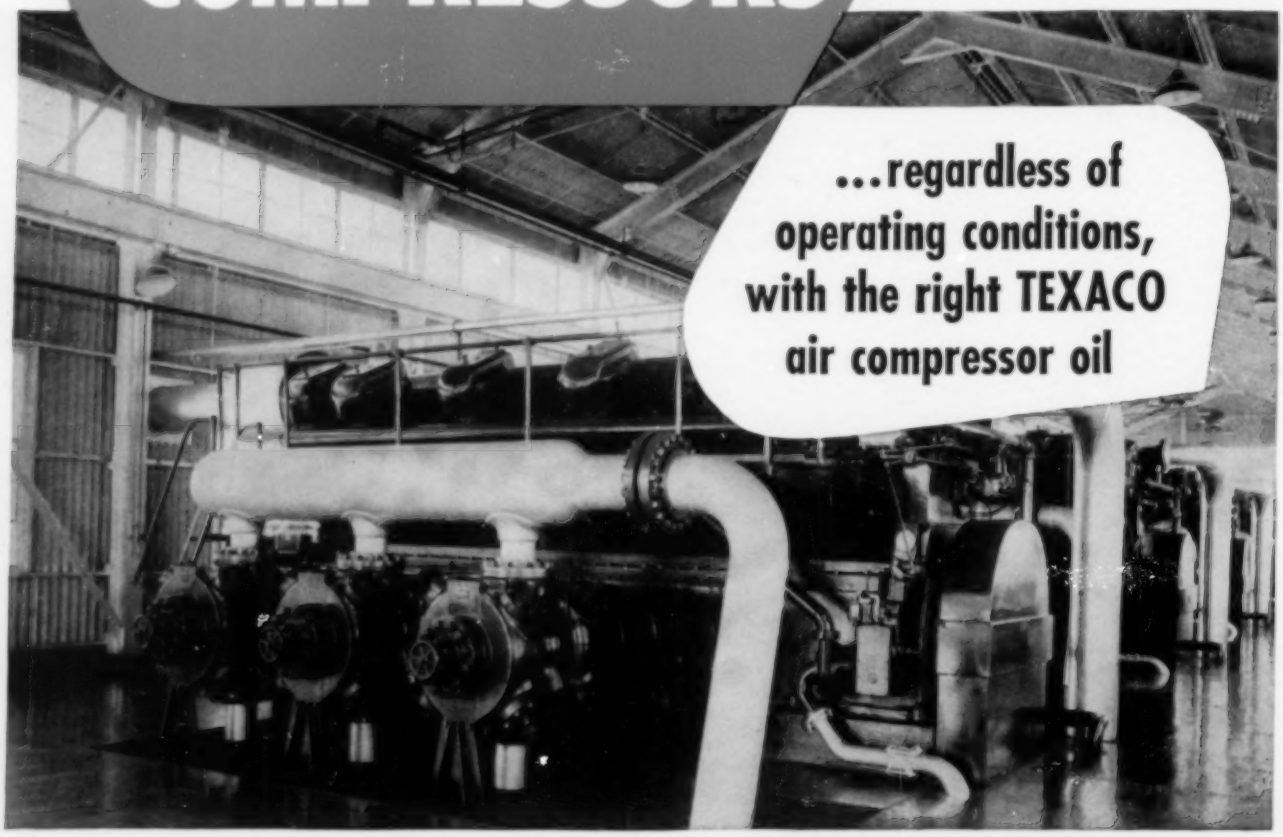
CONSTRUCTION MEN SET UP A GEYSER

Jetting earth from 30-inch driven steel casing with compressed air and water

(SEE INDEX PAGE AND PAGE 36)

VOLUME 57 • NUMBER 2 NEW YORK • LONDON

ASSURE CLEANER COMPRESSORS



THERE's no such thing as a satisfactory "all-purpose" air compressor oil. Different operating conditions call for different types of oil. That's why there is *a complete line* of Texaco air compressor oils — one for every requirement. A Texaco Lubrication Engineer will gladly survey your set-up and recommend the one exactly suited to your requirements — the oil that will assure you dependable, efficient performance and lower maintenance costs. For example —

★★**"WET CYLINDER" CONDITIONS** require a Texaco *compounded* air compressor oil to keep wear at a minimum.

★★**"NORMAL" CONDITIONS** are best handled by a Texaco *straight mineral* air compressor oil to assure clean operation, minimum wear, lower maintenance costs.

★★**ESPECIALLY SEVERE CONDITIONS** need a Texaco *heavy-duty* air compressor oil to prevent harmful deposits on valves and in lines.

★★**CONDITIONS CAUSING RUST** in cylinders, coolers, lines and receivers can be overcome by using a Texaco *rust-inhibited* air compressor oil to prevent rust formation whether the system is operating or idle.

Call in a Texaco Lubrication Engineer today. Just contact the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO Air Compressor Oils

FOR ALL OPERATING CONDITIONS

Faithfully yours

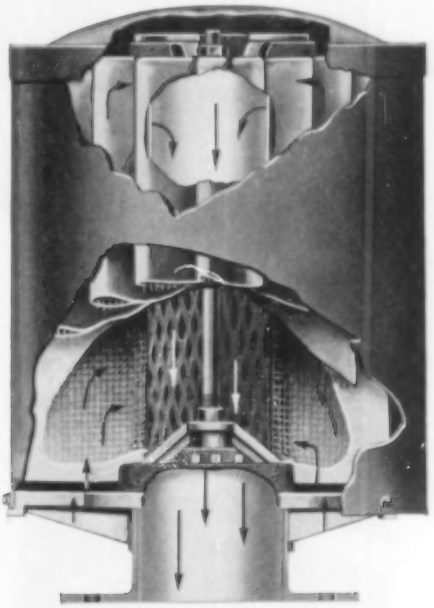
50 TEXACO

for Fifty Years

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon.

"LET'S SPECIFY STAYNEW INTAKE FILTERS

They give us positive protection . . . They won't need regularly scheduled maintenance . . . They're easy to clean on the job . . . Efficient over a wide range of loads . . . They're not affected by temperature change . . . There's no oil carry-over OUR EQUIPMENT WILL LAST LONGER!"



MODEL D
Intake Filter

Industrial engineers everywhere know that Staynew's *Positive Protection* lengthens equipment life. From compressors to generators . . . from blowers to internal combustion engines, Staynew Intake Filters stop dust and dirt from entering through air intakes, causing carbon accumulation and needless wear. And Staynew Filters frequently operate two or more years *without maintenance.* When cleaning is indicated, a brush or simple vacuum cleaning tool is all you need. Specify Staynew and increase productive time.

Write for Complete Booklet on Staynew Intake Filters.

Representatives in Principal Cities

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

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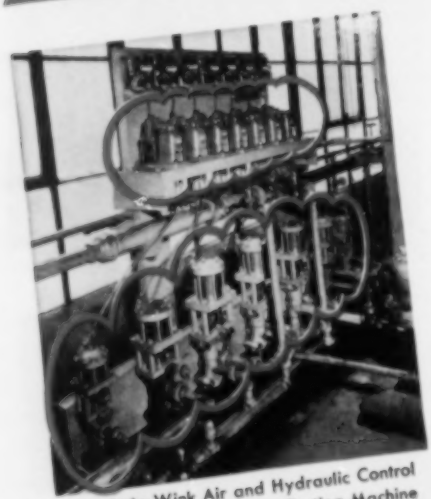
ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Special Built Machine for Exacting and Thorough Hydraulic Testing Heavy Duty Gate Valves

Quick-As-Wink Control Valves



Quick-As-Wink Air and Hydraulic Control Valves that Operate the Testing Machine Shown Above

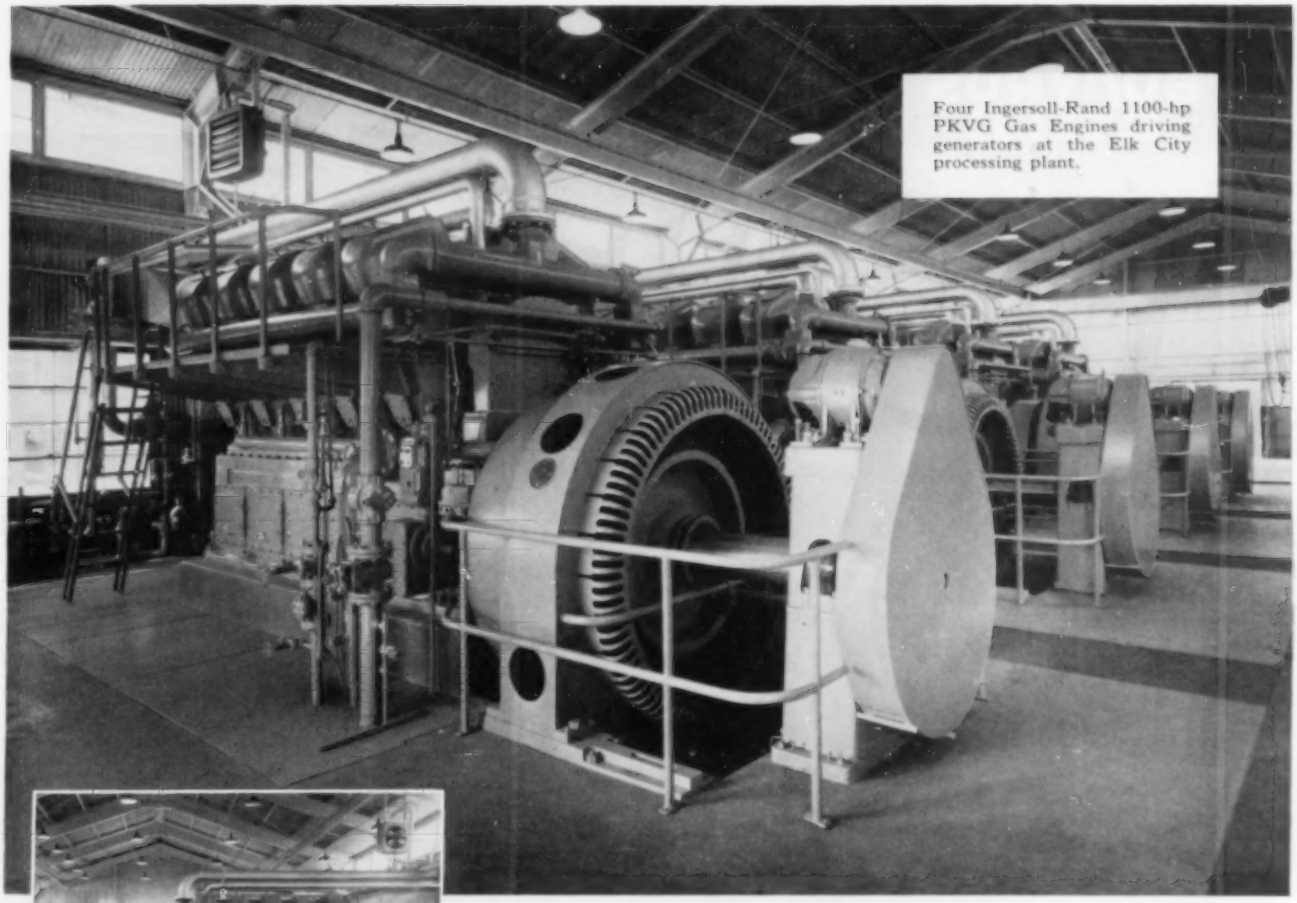
industry wide recognition for unsurpassed dependability

We think steel men know most about steel; rubber industry men know most about rubber; machine builders know most about machines; and valve men know most about valves. So when a large nationally known valve manufacturer chose Quick-As-Wink control valves for the exacting and thorough testing of his own heavy duty valves (see photo) we're pleased — but not surprised, because throughout the steel, rubber, machine building, and most other industries, men with experience usually prefer Quick-As-Wink Control Valves. Positive and fast-acting, every valve is designed and built for maximum air economy and the long, dependable trouble-free service you want in your operations.

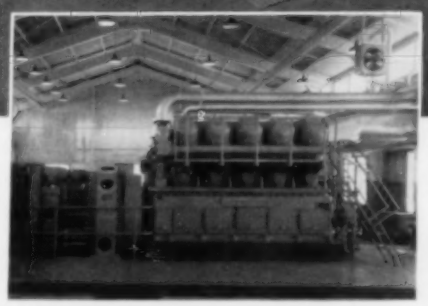
Quick-As-Wink
AIR AND HYDRAULIC
Control Valves

Hand, Foot, Cam, Diaphragm and Solenoid Operated

Mfd. by C. B. HUNT & SON, INC., 1911 East Pershing St., Salem, Ohio



Four Ingersoll-Rand 1100-hp PKVG Gas Engines driving generators at the Elk City processing plant.



ELK CITY PROCESSING AND GAS CYCLING PLANT Generates their Power with PKVG Gas Engines

Birth of an Oilfield

In 1946, Elk City was a sprawling agricultural community in western Oklahoma—typical of the kind of city that forms the backbone of this country. Oil geologists had probed the red soil of the rolling hill country around Elk City for many years. After starting oil drilling operations in September '46, it took 15 discouraging months of "nightmare" drilling and a $750,000 expenditure before success was achieved.

Today, with an investment totaling more than 32 million dollars, the Elk City oil and gas field processing unit is producing 15,000 barrels of crude oil daily, 225,000 gallons of natural gasoline and butane, and 55,000 gallons of propane.

All of the electric power at the Elk City Processing Plant is generated by four large PKVG units. Each engine develops 1080 bhp at 1960 feet altitude.

The PKVG is a modern V-type, heavy-duty gas engine—compact, accessible, and easy to install and operate. Its multi-cylinder, 4-cycle design assures smooth operation, reliability, and flexibility.

The low-cost maintenance and high operating economy of Ingersoll-Rand PKVG Gas Engines have become a tradition in the oil and gas industry. It took years of experience to build up this reputation—and all of this experience is at your disposal. Just call your nearest I-R representative.

Gas Engines: up to 1760 hp
Gas-Engine-Driven Compressors: from 110 to 1320 hp

4-CYCLE

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 706-6

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

BUCYRUS ERIE 6 YARD

150-B

Brings

POWE

t

NEW SPEED, R, CAPACITY

to loading and stripping

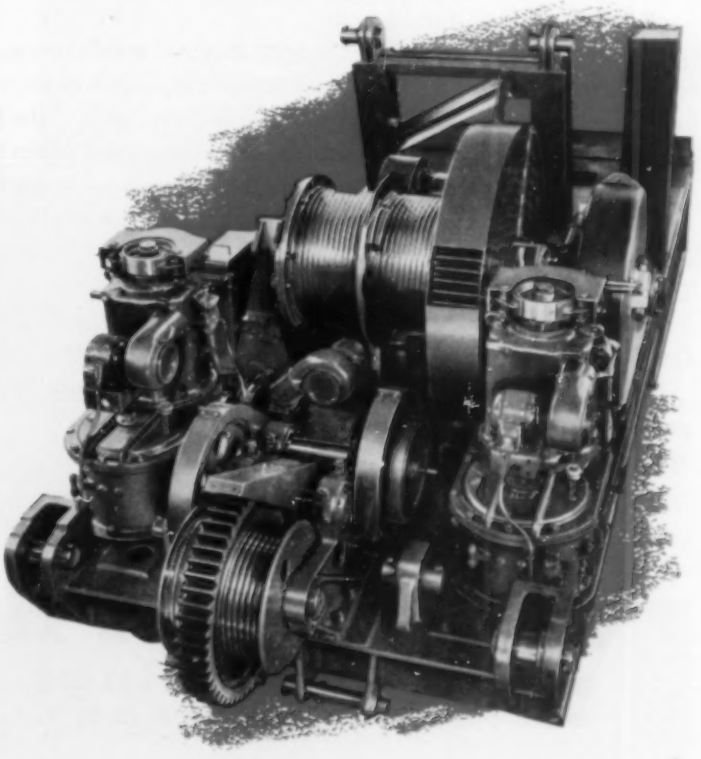
ADDED to the time-proved superiorities of design and construction which have made Bucyrus-Erie quarry and mining shovels traditionally "years ahead" are important features new to an excavator of this size, yet *thoroughly proved in the field.* Among these 150-B features are:

Exclusive Two-Section Boom with tubular dipper handle free to rotate in saddle block. Used with outstanding success on Bucyrus-Erie's large stripping shovels, this design speeds the working cycle and permits increased *payload* because it reduces front end weight materially yet provides enormous strength. Upper section carries only load resulting from pull of ropes, strong trussed lower section transmits directly to the revolving frame the vibrations, torsional and shock loads set up in digging. Rope crowd is quiet, positive, with crowd machinery located on the deck.

Powerful New Main Machinery designed for double twin hoist smoothly delivers power where you want it, when you want it. Hoist machinery pulls dipper straight through tough banks with steady positive action. Fast, smooth swing, with quick acceleration and deceleration, shaves seconds off every cycle.

Larger Stronger Mounting has new propelling machinery arrangement, which provides rapid engagement of the propel for fast move ups. Cored box-section tread links have separate flame hardened wearing paths for rollers and driving tumblers. Cat belts have high wear resistance, stay in adjustment for long periods.

The 150-B has full Ward Leonard independent motor control, is fully convertible to dragline service, features numerous other design advances that make it truly "years ahead". 1L52C



BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin

NOBODY GUESSES WHEN YOU USE . . .

WALSEAL*

FOR MAKING SILBRAZ* JOINTS

When you see this fillet of alloy, and the fitting is Walseal you know that you have penetration because the alloy comes from the inside.

Cutaway view of a Walseal Tee showing: 1—factory-inserted ring of silver brazing alloy; 2—fillet of silver brazing alloy that appears upon completion of Silbraz joint; 3—cutaway view of the completed Silbraz joint showing that silver brazing alloy has flowed in both directions from the factory inserted ring.

When you make Silbraz* joints in your brass, copper, or copper-nickel pipe lines with Walseal Valves, Fittings, or Flanges you know you have the right amount of the correct type of silver brazing alloy. The ring of Sil-Fos brazing alloy is factory-inserted in the ports of Walseal products at the time of manufacture.

No lost time or motion in handling the alloy . . . no difficulty in getting full penetration of the alloy regardless of the position of the valve or fitting . . . no guessing whether the joint is made right . . . the fillet of alloy that shows up when the Silbraz joint is completed, comes from the inside!! And, whether you've made the Silbraz joint yourself, or inspecting the work of another, you know that if the silver alloy fillet is visible, and the valve or fitting is Walseal, you have full penetration. That's why nobody guesses when you use Walseal!

Walseal products are backed by the reputation of the Walworth Company, manufacturers of valves and pipe fittings since 1842.

For full information regarding Silbraz joints made with Walseal products, write for Circular 84.

*Patented—Reg. U. S. Pat. Off.

Recommended for

Hot and Cold Water Circulating Systems

Boiler Feed Lines

Steam Return Lines

Condensate Lines

Low and High Pressure Air Systems

Lubricating Oil Circulating Systems

Industrial Gas Piping

Solvent and Vacuum Piping Systems

Make it "a one-piece pipe line" with WALSEAL

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

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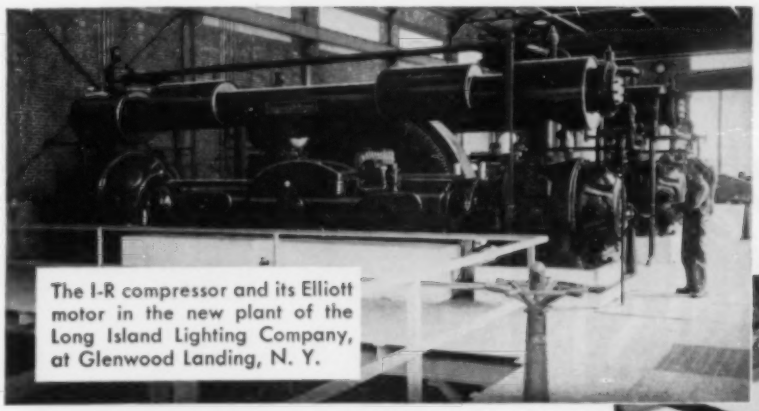
LARGE ELLIOTT MOTOR

...drives gas compressor

for maximum capacity

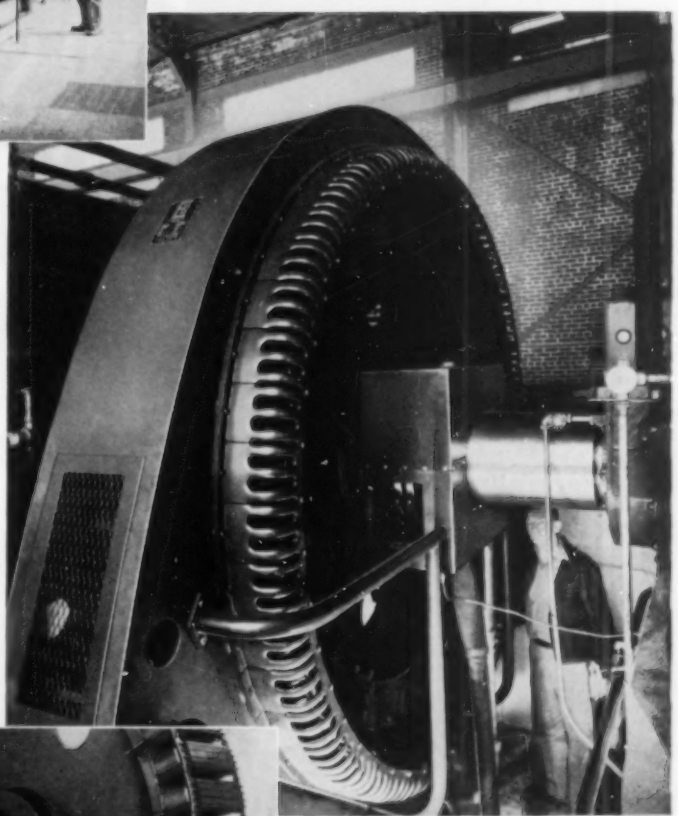


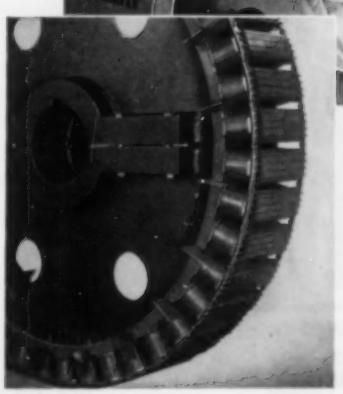
The I-R compressor and its Elliott motor in the new plant of the Long Island Lighting Company, at Glenwood Landing, N. Y.

At the new Glenwood Landing (N. Y.) plant of the Long Island Lighting Company an Elliott 2000-hp engine-type synchronous motor drives an Ingersoll-Rand type PRE-2-4C compressor to serve the rapidly expanding needs of Long Island's home developments.

With the flexibility of Elliott "Fabri-Steel" construction, the motor is designed specifically for its job. The rotor is split to permit mounting on the compressor crankshaft, and engineered with sufficient flywheel effect to prevent the reciprocating motion of the compressor from causing objectionable pulsations in the electrical system. Enclosed collector rings eliminate fire hazard.

The many superior construction details of Elliott low-speed synchronous motors are fully covered in Bulletin 5000-2. Address Dept. C.A.





Close-up of the motor, showing explosion-proof, ventilated collector ring enclosure, with lucite windows for visual inspection.

•

The rotor is of full-split construction, with edge-wound copper strap field coils. Starting winding bars are silver-brazed to the end ring segments for low resistance and for permanent tightness.

E-812

ELLIOTT COMPANY

DEPT. CA

RIDGWAY DIVISION • RIDGWAY, PA.

Plants At: JEANNETTE, PA. • RIDGWAY, PA. • AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.

District Offices in Principal Cities

Instant Automatic Flow and Shut-Off

Quick Connection and Disconnection

WHY *Genuine* HANSEN COUPLINGS GIVE BETTER SERVICE LAST LONGER

LEAK-PROOF, Minimum Wear Locking Device

Integral Factory-Assembled Tamper-Proof Socket Head

PICK GENUINE HANSEN COUPLINGS FOR HANSEN PERFORMANCE...

Locking pins in Hansen Push-Tite Coupling Socket afford large area contact with plug, thereby preventing wear and subsequent leakage.

● The ability of Hansen Push-Tite Couplings to withstand severe service—with practically no maintenance—has been thoroughly proved by years of hard everyday use in thousands of plants. The "socket head", which contains the locking device, is factory assembled into a rugged integral unit which cannot be readily injured or have component parts lost by casual tampering.

To connect the coupling, you merely push the plug into the socket with one hand. Flow is instantaneous. To disconnect, push back sleeve on socket—coupling disconnects. Flow is shut off instantly and automatically.

Write for catalog giving complete range of types and sizes.

QUICK CONNECTIVE FLUID LINE COUPLINGS *for*
AIR • OIL • GREASE • HYDRAULIC FLUIDS
WATER•VACUUM•STEAM•OXYGEN•ACETYLENE
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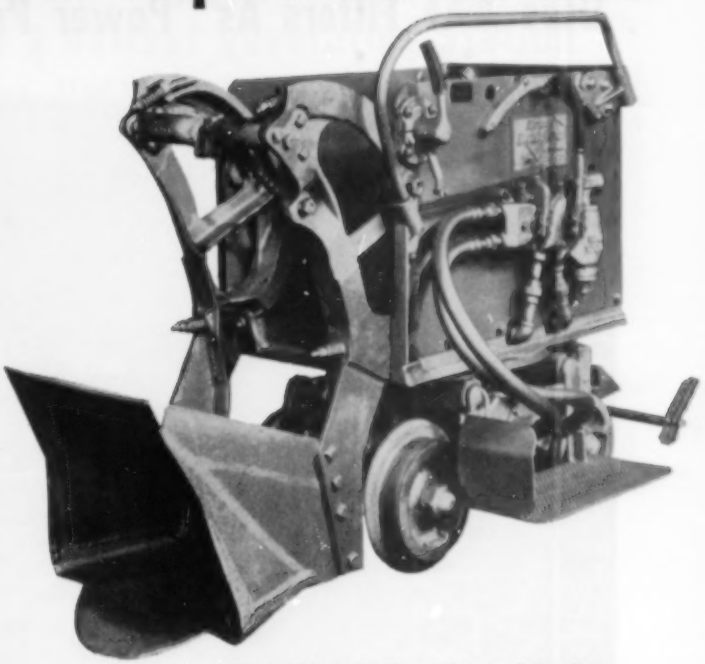

Eimco 12B RockerShovel for small headings. Cages in 28"x44". Powerful, fast, dependable, efficient with exclusive safety features.

Eimcos do a better job in loading because they're actually top quality machines. They're powerful, efficient and rugged. The use of alloy steel castings and anti-friction bearings make them the most dependable loader on the market. Exclusive design features make them safe and free from troublesome gadgets—easy to operate.

The records of top mining companies and contractors show that Eimcos load at a lower cost per ton, are more reliable on the job and have a higher resale value.

Specification sheets are available on all Eimco RockerShovels. Wr'te for them. Your friends in the mining or contracting business will tell you, "You can't beat an Eimco."

EIMCO

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The World's Largest Manufacturers of Underground Rock Loading Machines

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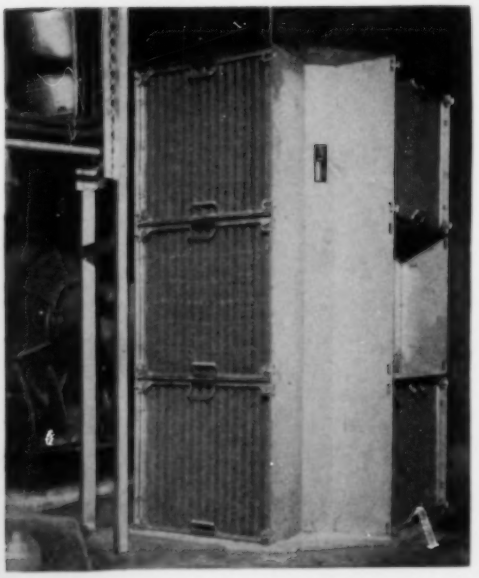
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

A356

KAISER ALUMINUM

Uses AAF Filters As "Power Protection"



▲ 8-Unit Type PL-H Amer-Aire Intake Filter, one of which serves each of the eighty engines.

◀ View of main power plant showing portion of the 80 Nordberg Radial-Type Gas Engines.

New Chalmette, La., Reduction Plant Goes into Production with Clean Air Assured for 80 Radial-Type Gas Engines

"Heart" of the Kaiser Aluminum & Chemical Corporation's new aluminum reduction plant is this power station where 80 Nordberg Radial-Type Gas Engines drive a like number of generators. Supplying clean air for these engines imposes exacting demands on the filters. The very handling of the fine alumina powder creates a dust problem of major proportions. Added to this, you have a climate where excessive moisture is most common.

The filters selected for the job—eighty 8-unit Type PL-H Amer-Aire Intake Filters. This dry-type filter, featuring disposable Airmat filtering media, is particularly effective in cleaning air containing both excessive moisture and a high volume of fine dust.

This is the second large Gulf Coast aluminum plant where Amer-Aire Intake Filters have been installed on the engines. The reason—a complete line of filters to meet every need, whose effective design and performance have been proved in fact as well as theory. A mighty good reason why you should specify the "power protection" of AAF Amer-Aire Intake Filters.

Today's Best Buy is Better Air!

AAF

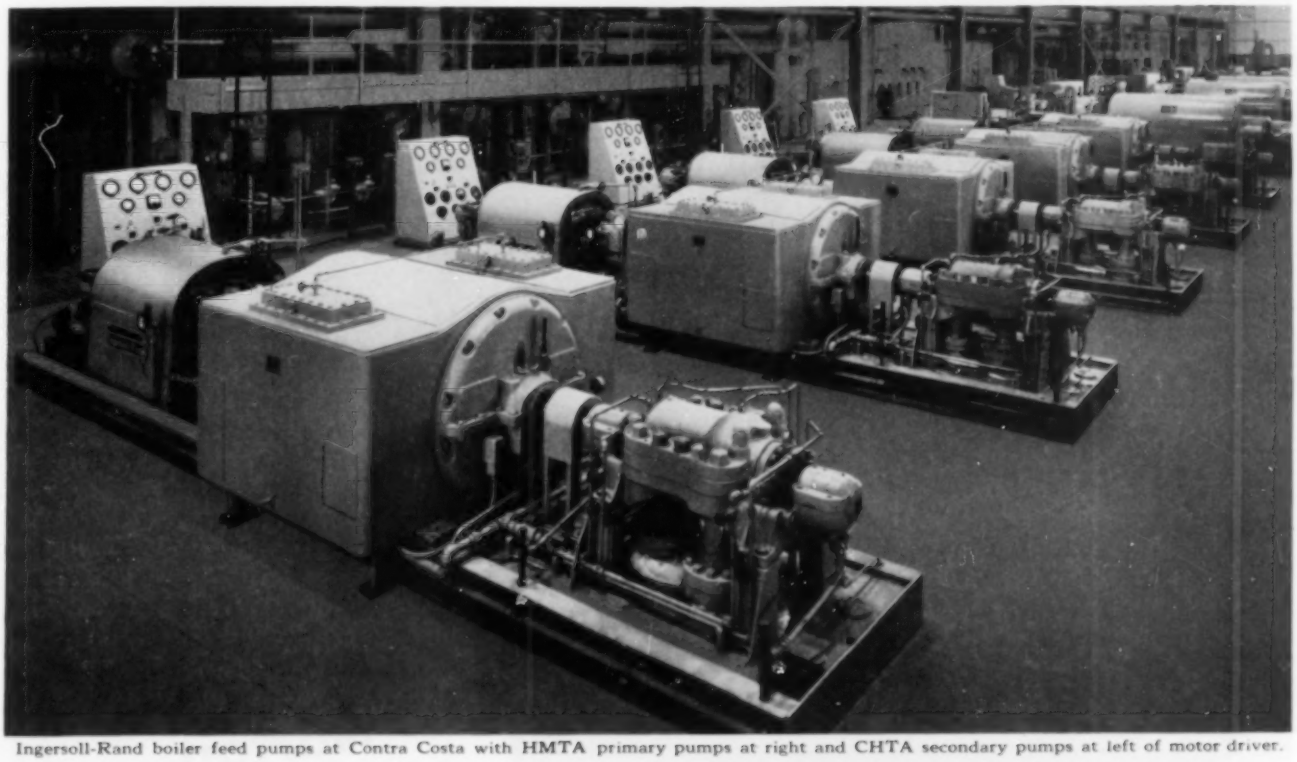
American Air Filter

COMPANY, INC.

402 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.

I-R PUMPS SERVE CONTRA COSTA

Pacific Gas and Electric Company's newest generating station uses Ingersoll-Rand's new Class HMTA boiler feed pumps

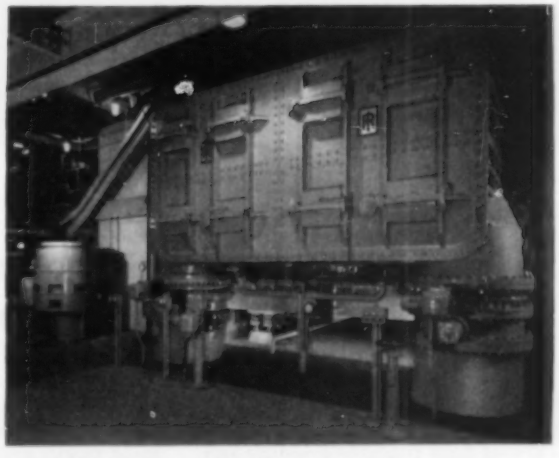


Ingersoll-Rand boiler feed pumps at Contra Costa with HMTA primary pumps at right and CHTA secondary pumps at left of motor driver.

The Pacific Gas and Electric Company's new and ultra-modern steam plant at Antioch, California will make available 300,000 kw to help meet the high system load of the productive Contra Costa county area. This modern boiler feed pump installation – incorporating both the new HMTA and the popular CHTA pumps – is designed to establish new standards of high pressure pumping economy.

The Contra Costa Station uses the two-pump feedwater system – each pump set carrying half the load of a 100,000 kw generating unit. The six-inch, 3-stage HMTA primary pumps, which handle 228° water at 24 psi, discharge to the low pressure heaters at 574 psi. The five-inch, 8-stage CHTA "double case" secondary pumps take 430° water at 520 psi and deliver 1310 gpm at 1990 psi. Tandem mounting permits centralized lubrication and low temperature injection from primary pump to stuffing boxes of secondary unit, which means longer packing life.

Ingersoll-Rand Class HMTA multi-stage centrifugal pumps, with advanced design and a Unit-Type rotor assembly, are available in capacities to 1600 gpm and pressures to 1200 psi. Your nearest I-R representative will be glad to give you complete information.



CONDENSERS AND AUXILIARIES ARE I-R TOO

Three, 50,000 sq. ft. I-R rectangular condensers are supplied with almost 270,000 gallons of cooling water per minute by six, 36″ Class APM pumps. Condensate from the units is handled by six, 16″ Class APHC, four-stage vertical pumps.

Ingersoll-Rand

Cameron Pump Division, 718-10
11 Broadway, New York 4, N. Y.

PUMPS • COMPRESSORS • CONDENSERS • ROCK DRILLS • AIR AND ELECTRIC TOOLS • DIESEL AND GAS ENGINES • VACUUM EQUIPMENT

NEW!
The Flexible
Norton
REINFORCED
RESINOID
Hub Wheel

Adds new speed, ease and safety to your portable grinding jobs

This new Norton BFR flexible *Reinforced* Hub Wheel is sure to step up the efficiency of your portable grinding and sanding equipment because:

It's a fast-cutting wheel . . . thanks to its sharp, durable ALUNDUM* abrasive and special resinoid bond.

It's a time-saving wheel for blending in contours and corners because it has the necessary flexibility.

It's a safe, strong wheel because it has *extra* fabric reinforcement molded into it. It holds together even if it should be accidentally cracked.

It can't be beat for cutting off small gates and risers and notching big ones, smoothing welds and contours, removing mold marks and rust prior to painting.

Team up this new Norton BFR flexible *Reinforced* Hub Wheel with the heavy-duty Norton BD semi-rigid Hub Wheel and you'll multiply the number of jobs you can profitably do with your portable grinders and sanders.

Ask your nearby Norton distributor about Norton BD and BFR *Reinforced* Hub Wheels. He's listed under "Grinding Wheels" in your classified telephone directory. Or write direct to Norton Company, Worcester 6, Mass. Distributors in all principal cities. EXPORT: Norton Behr-Manning Overseas Inc., Worcester, Mass., New Rochelle, N. Y.

NORTON
ABRASIVES
Making better products to make other products better

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

ON THE COVER

A BRIDGE being built near Buffalo, N. Y., to carry the New York State Thruway (express highway) over railroad tracks will be supported on steel pipes driven approximately 27 feet into the ground to sound rock and filled with reinforced concrete. As the shells had open bottoms, the earth entered them as they went down and it was necessary to remove these cores before pouring concrete. This was readily accomplished by injecting compressed air and water. Our cover picture shows a shower of mud and water emerging from a pipe during the initial stages of the cleaning operation.

•

IN THIS ISSUE

TUMBLING rivers are potential power sources, and Canada has so many of them that it can grow for years to come without running out of "white coal." Our leading article tells of the sixth large hydroelectric plant put in service on the St. Maurice, a stream conveniently located with respect to some of the Dominion's greatest concentrations of people and industries. Four more good sites on the same river remain to be developed.

•

BECAUSE any job that can be divided up can be made easier, it was possible to raise a 4000-ton bridge a vertical distance of 17 feet without a hitch. Sixteen powerful air-operated jacks working in unison lifted one-quarter of the 1500-foot structure 30 inches and were then moved to another section. Meanwhile, traffic used the bridge, with delays of not more than 30 minutes at a time. Page 38.

•

MAGNESIUM is so new to industry that there has been little opportunity to explore its possible applications, but there are known to be many. Because it can be etched with acid faster than any metal previously used in the photoengraving industry, it is of interest there. Taking advantage of this characteristic, a Pennsylvania engraver has developed a magnesium printing cylinder that appears to have great potentialities. Page 42.

•

ACCORDING to Arthur D. Little, Inc., a railroad that uses a million ties can save $150,000 by increasing their service life one year. It is understandable, then, why the carriers pay a lot of attention to these little-noticed pieces of timber. How the Santa Fe handles this important matter is told in *The Ties That Bind*. Page 47.

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G. W. MORRISON, *Publisher*
C. H. VIVIAN, *Editor* J. W. YOUNG, *Director of Advertising*
ANNA M. HOFFMANN, *Associate Editor* J. J. KATARBA, *Business Mgr.*
J. C. PIERCE, *Assistant Editor*
A. W. LOOMIS, *Assistant Editor* JOSEPH C. DILTS, *Advertising Mgr.*
D. Y. MARSHALL, Europe, 243 Upper Thames St., London, E. C. 4.
F. A. MCLEAN, Canada, New Birks Building, Montreal, Quebec.

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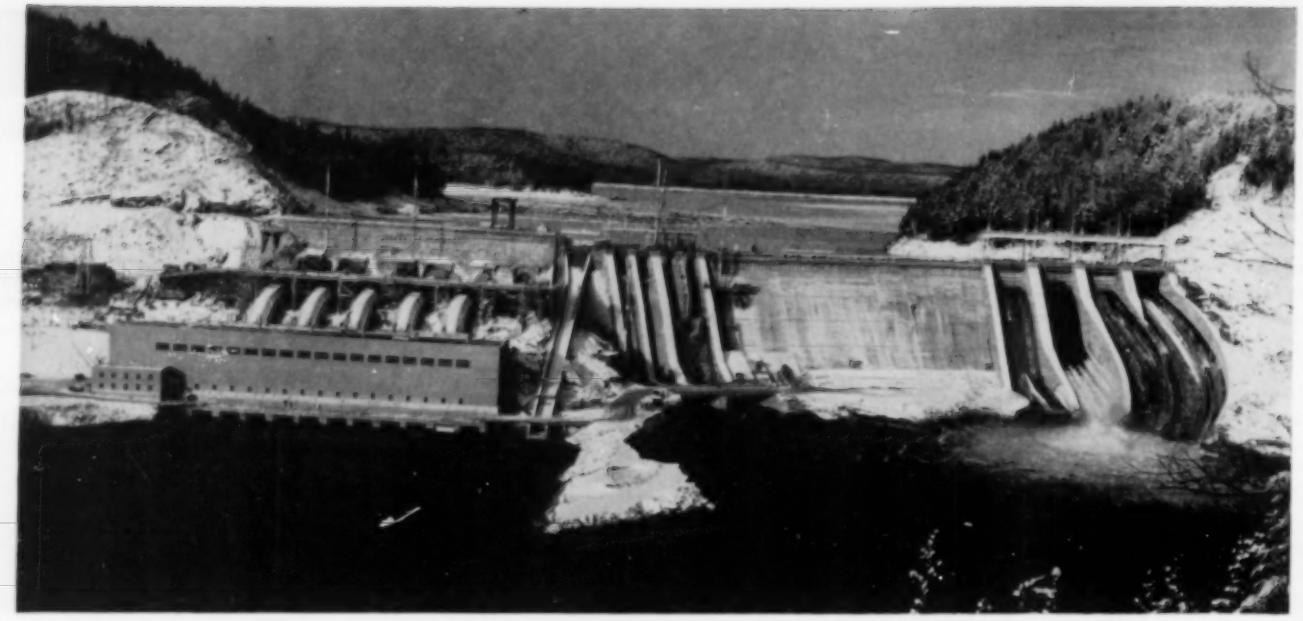


GENERAL VIEW

The Trenche development as it looked when nearing completion. At the site was a series of rapids running between rather steep banks. The dam is 1500 feet long and 230 feet high. At the left is the powerhouse, with five penstocks to carry water to the turbines. Next to it is a chute to pass logs, of which huge quantities are floated down the St. Maurice. Right of the chute are four regulating gates and, at the extreme right, four floodgates.

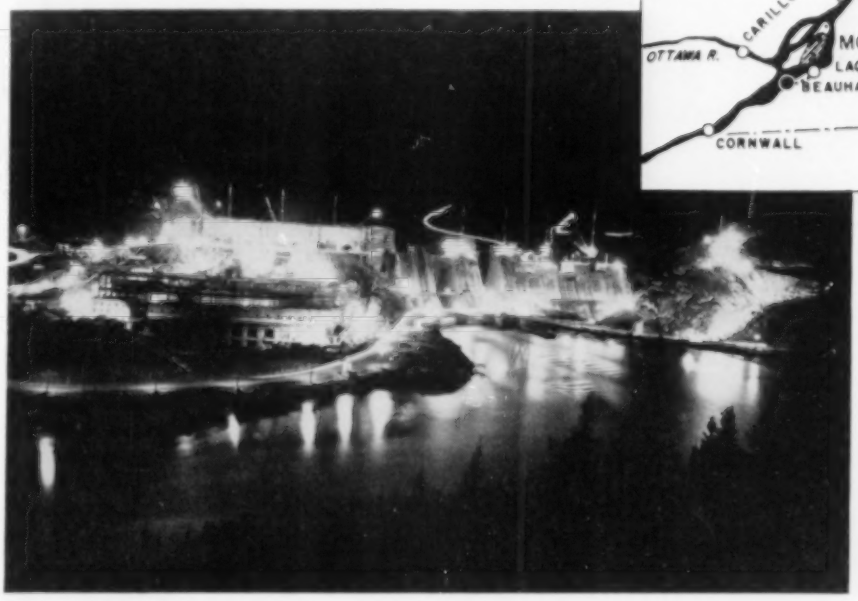
CONSTRUCTION CAMP IN WINTER

Trenche townsite during the winter of 1948, when 2000 persons lived there. The town will not be permanent because the power-plant employees will reside at Rapide Blanc where stores, schools and houses are available.

Trenche Power Development

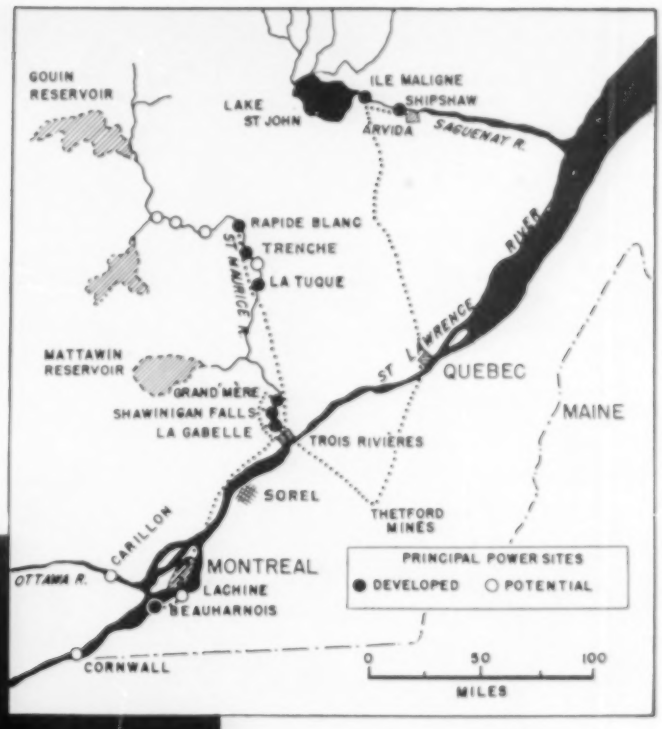
Shawinigan Water & Power Company Now Operating Its Sixth Hydro Plant on St. Maurice River

W. M. Goodwin



UNDER THE LIGHTS

Night view when construction was at its height. The tailrace was excavated within a cofferdam at the right. By comparing this picture with the one on the preceding page it is possible to distinguish the main features.



LOCATION MAP

The chart shows the developed as well as the potential power sites on the St. Lawrence and its tributary St. Maurice and Saguenay rivers. The dotted lines indicate the transmission network connecting generating plants.

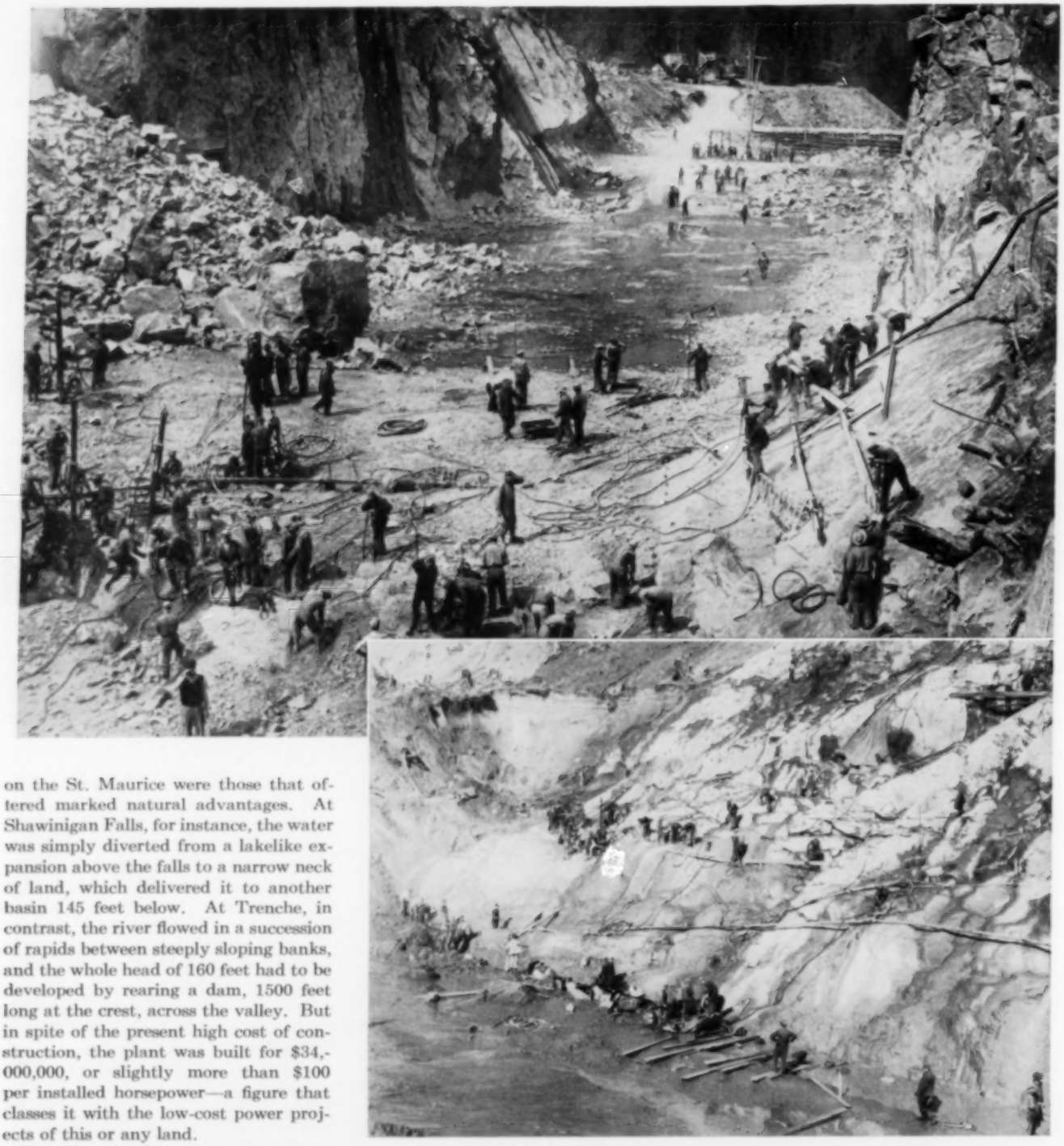
MORE than half a century back, The Shawinigan Water & Power Company commenced its career as one of the pioneer hydroelectric utilities of Canada. Its first plant used but little of the St. Maurice River's flow at Shawinigan Falls. In November, 1950, the company drew power from the sixth large project on that waterway, which extends 200 miles northward from its junction with the St. Lawrence at Trois Rivières. These stations have an installed capacity of more than 1,500,000 hp. Four sites remain to be developed, and when these are at work, and proposed generators have been added to existing plants, the St. Maurice will be capable of furnishing about 2,500,000 hp. What a record for one comparatively small river!

The first 65,000-hp unit of the newest station, which is located at Trenche, was completed last November, seven months ahead of schedule. Four more followed it in quick succession to give a total of 325,000 hp. A place has been left for a sixth, which is to be installed in due course. Meantime, the demand for power in the Province of Quebec has increased more rapidly than anticipated, and plans for the development of a seventh site at Rapide Sans Nom, 17 miles downstream from Trenche, may have to be expedited to provide a supplemental block of 252,000 hp.

The 325,000 hp generated at Trenche came just in time to meet the mounting requirements of customers, old and new, in Shawinigan's broad territory, which covers the greater part of Quebec's industrial centers and its principal agricultural areas. The largest new consumer is the Quebec Iron & Titanium Corporation whose plant is at Sorel on the south shore of the St. Lawrence and midway between the mouth of the St. Maurice and Montreal. Its contract calls for 160,000 hp., nearly half of the present Trenche capacity, which, it is expected, will be needed by the end of 1952 when all five of the large reduction furnaces for the treatment of iron-titanium ore are to be in operation. The remaining half of the energy is none too much to meet the other commitments of Shawinigan Water & Power.

Fortunately there is now a complete hook-up of Quebec's three great hydroelectric systems: the Saguenay area is connected with the Shawinigan network on the north, while the publicly owned Quebec Hydro centered on Beauharnois joins them on the west. They work together closely for the common good, and a rather remarkable saving in power has already resulted in consequence. The Beauharnois station, on the steady-flowing St. Lawrence, can run continuously with economy as to water because it will flow by unused if it does not go through the turbines. The St. Maurice and Saguenay systems, on the other hand, have vast reservoirs on which to draw for peak-load demands and in which the surplus can be stored during off-peak periods.

The first power sites to be developed



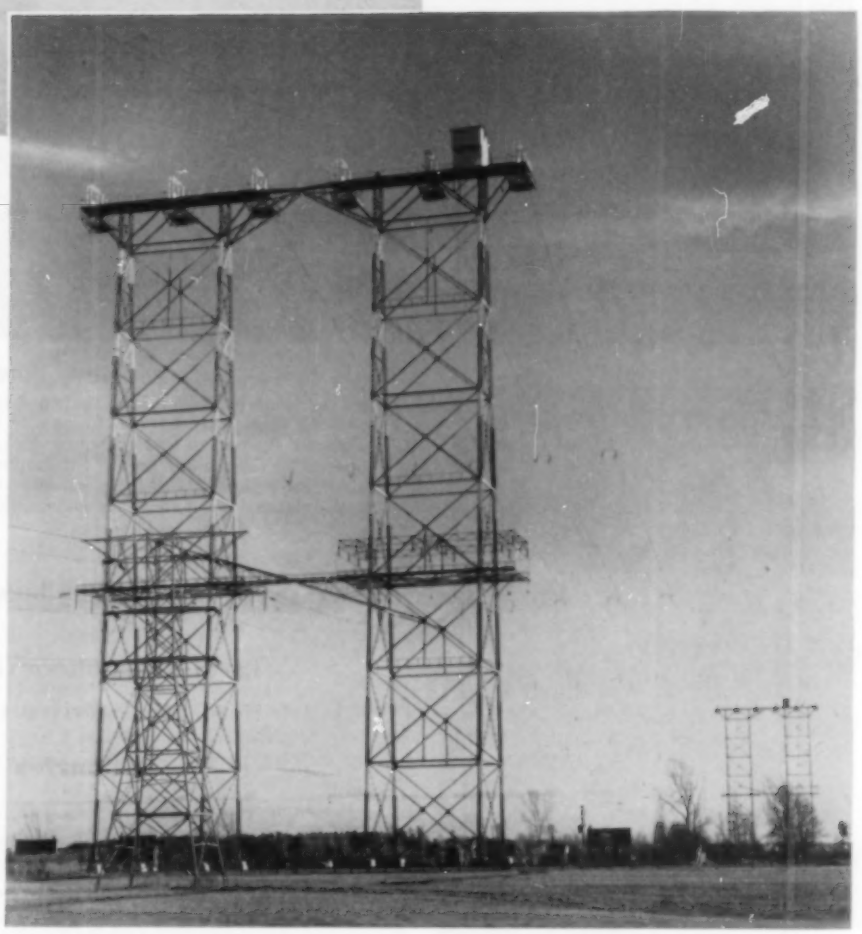
EXCAVATION

To divert the river during construction, the by-pass channel seen at the top was excavated in rock. Ten Canadian Ingersoll-Rand DB-30 drifter drills on lightweight Wagonjack mountings and numerous 50-pound hand-held Jackhamers were used. The other picture shows drillers carving out a site for the powerhouse. Compressed air for operating the drills was furnished by two I-R Type XVH compressors, each of 1000-cfm capacity.

on the St. Maurice were those that offered marked natural advantages. At Shawinigan Falls, for instance, the water was simply diverted from a lakelike expansion above the falls to a narrow neck of land, which delivered it to another basin 145 feet below. At Trenche, in contrast, the river flowed in a succession of rapids between steeply sloping banks, and the whole head of 160 feet had to be developed by rearing a dam, 1500 feet long at the crest, across the valley. But in spite of the present high cost of construction, the plant was built for $34,000,000, or slightly more than $100 per installed horsepower—a figure that classes it with the low-cost power projects of this or any land.

The Trenche dam is of the gravity type. It rises to a maximum height of 230 feet from sound rock and has a maximum width of base at that point of 225 feet. The disposition of the powerhouse, the four large floodgates and the four regulating gates can be noted in the accompanying photographs. Economy of excavation dictated the unusual shape of the floodgate discharge. The chute alongside the power plant is designed for logs and delivers them into the tailrace where they are unlikely to be caught in an eddy. It is a particularly important part of the installation, because the watershed of the St. Maurice is one of Canada's greatest pulpwood areas and the river insures transportation to the mills at minimum cost.

The maximum discharge through the dam is 170,000 cubic feet per second: 4000 for each of the five turbines, 7000 for each regulating gate, and 30,500 for each floodgate. The headpond reaches upstream for a distance of 6 miles to the tailrace of the Rapide Blanc station, which was put in operation in 1934. This man-made lake is 3600 acres in extent. Though useful for local regulation of the water supply, it is of no value for storage. Between Trenche and Rapide Blanc, a distance of 12 miles, there is a good road, and the operators at both plants live in the latter community, thus avoiding a duplication of housing,



MARKETING THE POWER

A large percentage of the output of the new plant will be used in the titanium refinery of Quebec Iron & Titanium Corporation at Sorel, Que., (see map) on the St. Lawrence. A general view of the smelter under construction is shown at the left. Also pictured are the twin 375-foot towers of the transmission lines that carry current across the river to Sorel. Towers on the right, erected in 1940, carry two circuits of 110,000 volts each. Those on the left, put up in 1950, support a single 230,000-volt circuit.

schools, churches and other facilities.

Excavating for the dam and powerhouse involved the removal of 335,000 cubic yards of material, and for the tailrace, by-pass, sluice and flood channel 740,000, or a total of 1,075,000 yards made up of approximately 60 percent earth and 40 percent rock. Removal of the latter, around 450,000 yards, necessitated drilling an aggregate of 900,000 feet of hole, or 1.8 feet per yard broken. About 250,000 pounds of dynamite was used, or 0.5 pound per yard of rock.

The whole job called for the pouring of 550,000 cubic yards of concrete, of which 250,000 went into the main dam and 50,000 into the power station. Coarse aggregate for mixing concrete was obtained well-nigh entirely from rock excavated at the site, only 60,000 yards being quarried for the purpose. Sand was found within convenient reach a few miles away.

Following the tendency of recent years in the Dominion, large-capacity generators have been installed in the Trenche plant in conformity with the 60-cycle power that will soon be universal throughout Canada. Each is of 53,000-kva capacity with 90 percent power factor and 97 percent efficiency at full load. The water-cooled thrust bearing is designed to support a load of 215 tons, the combined weight of the rotor and the turbine runner. The latter is of the Francis type.

Five main transformers raise the voltage from 13,800 to 230,000 for transmission to the company's terminal station at Trois-Rivières, whence power for the whole system is distributed at various voltages to Sorel, Montreal and other distant markets. There are two auxiliary transformers, each of 1000-kva, which step down the 13,800-volt current developed by the generators to 575 volts for driving pumps, gate motors, and air compressors and for other auxiliary services throughout the powerhouse.

In contrast with the first hydroelectric plants erected on the St. Maurice and elsewhere, the equipment is now made, well-nigh without exception, in Canada. In fact, domestic manufacturers of hydraulic and electrical machinery are among the leaders in their respective fields.

At the point where the transmission line extends across the St. Lawrence to Sorel the river is about 3900 feet wide, and spanning it was a major undertaking. Shawinigan Water & Power had already made a successful crossing of the St. Lawrence 40 miles downstream from Sorel in 1917. The first span is 4800 feet long and carries 125,000 hp at 110,000 volts to augment the small local block of energy that did not meet the needs of the industrial and mining centers of the eastern townships, including Sherbrooke, where the plant of Canadian Ingersoll-Rand Company, Limited, is located, and the famous asbestos region around Thetford. In May, 1940, a second line, carrying two 110,000-volt circuits, was completed at Sorel. It was made necessary by the establishment of important wartime industries in and about that city and provided an additional link with the south-shore systems. This crossing has a central span of 3930 feet and is suspended between towers 375 feet in height. The newest span is of the same dimensions as the earlier one but carries a single circuit of 230,000 volts. It was built in 1950 to serve the works of the Quebec Iron & Titanium Corporation.

BLOWING POWER EQUIPMENT

In the center foreground are two Ingersoll-Rand portable air compressors, a 315-cfm unit and, beyond it, one of the new type 600-cfm rotary machines. Both are connected to a 600-cubic-foot storage receiver. Success of the blowing operation, the author points out, depends on having adequate compressor and air-storage capacity. At the left and right are rows of steel cylinders driven to rock, cleaned out and fitted with reinforcing cages ready for pouring concrete.

BLOWPIPE

The 57-foot-long pipe is 10 inches in diameter except at the near end, where it is belled out to 27 inches. Running along the left side and through the funnel is the jet pipe.

Cleaning Hollow Piles with Air

Earth Cores Blown Out of Open-ended Steel Shells Driven to Support Bridge

Charles R. Waters*

COMPRESSED air is one of the important items used in constructing certain types of modern foundations for bridges and other structures. Since the turn of the century, these supporting members have undergone many new developments. Most of the structures on the old Erie Canal were of cut-stone masonry laid on timber grillage to form spread foundations. In the building of the Barge Canal, 75 years later, timber piles were driven extensively for lock and bridge foundations.

Today, the use of timber piles has not been entirely discontinued, but other kinds have come into prominence. These include the steel H-beam pile, the precast-concrete pile and the steel-shell pile. The latter may be a tapered, fluted shell, a thin sheet-steel shell of uniform diameter driven with the aid of a mandrel, or a heavy steel shell either closed or open-ended. Obviously, one of the major problems with the open-end type is the thorough cleaning it must be given prior to filling it with concrete.

Recently, in constructing the New York State Thruway at a point where it crosses the Delaware, Lackawanna & Western, the Erie, and the Lehigh Valley railroads east of Buffalo, steel-sheet pipes or tubes, 30 inches in diameter and filled with reinforced concrete, were installed as piles or columns to support a multispan bridge to carry the traffic over the tracks. As current literature regarding the work is not extensive, this article will endeavor to describe some of the methods used by the contractor, particularly those with which the cleaning was done.

The structure will have an over-all length of 1030 feet, a width of 113 feet, and will cost nearly two million dollars. The vertical clearance over the railroads will be 22 feet and the approach grades 3 percent. There will be eleven piers; and a total of 88 shells, ranging

*District Engineer, New York State Department of Public Works, Buffalo, N. Y.

in length from 50 to 54 feet, were driven to table rock at an average depth of 27 feet from the ground surface.

As delivered to the job, the pipes were about 40 feet long, and sections were welded on to give them the proper length for their respective locations. This was done by a portable arc welder developed by The Linde Air Products Company and known as Union Melt. During this operation the shells were turned in a jig by means of a Kinmont pipe turner. The same jig was used in cutting the shells.

For handling the long pipe sections the contractor utilized a large Lima locomotive crane with an 80-foot boom attachment. Driving was done by a 50-C double-acting Vulcan hammer securely placed in a specially constructed basket carried in front of the conventional leads, which consisted of steel I-beams 90 feet long. Steam for the hammer was supplied by a boiler fired with fuel oil. Penetration was about 1 inch per blow until a shell was approximately three-quarters down; then the rate was around ½ inch per blow until rock was reached.

Before a pile was driven, it was accurately positioned in a slightly larger wooden box that was left in place while sinking was in progress. This obviated the uncertainty as to proper pipe location often experienced when single-stake marking is used.

As the shells were of the open-end type (without a cap), the underground portion was filled with earth. The contract therefore provided for cleaning the tubes in addition to placing the reinforcement and pouring the concrete. But before undertaking this work the contractor conducted experiments to determine the most efficient and thorough cleaning method. It was found that an air receiver with a capacity of approximately 600 cfm was needed for the job. This tank was kept supplied with air by two Ingersoll-Rand compressors, one a rotary-type, diesel-powered 600-cfm unit, and the other a gasoline-driven 315-cfm machine. Both discharged at 100 psi pressure.

The outlet of the air receiver consisted of a 2½-inch pipe with a throttle valve for the control of the entire air-pressure system. Connected to this discharge pipe by a reducing tee and elbows were two parallel 2-inch lines about 40 feet long. The latter were again elbowed at their far ends and brought into an expansion tee, which formed a 2½-inch service outlet leading to a jet—a 1 13/16-inch (inside diameter) metal pipe about 60 feet long.

Connected to one of the parallel air lines at about the three-quarter point was a 2-inch water pipe provided with a shutoff valve, and in each of the air lines immediately back of the water intake pipe was installed a check valve to prevent any water backing into the air-storage system. The water was taken from a public-utility hydrant at 120 psi pressure and stepped up to 200 psi by a 4-stage jet pump before its entrance into the air line. A 2½-inch hose, approximately 125 feet long and having a flexible metal gooseneck fitting, connected the service outlet of the air-water system to the jet pipe.

Assembled as described, the equipment was ready for the blowing operation. The jet was introduced into a shell, water admitted under pressure, and the jet progressively lowered until it reached the bottom of the tube. Water pressure alone usually raised the contained clay cylinder 10 to 20 feet. When the water completely filled the shell, the supply was turned off and air pressure applied to eject the water and all loose material. As further cleaning was always necessary, a 10-inch H-beam, 30 feet long, was suspended from the crane boom and alternately raised and dropped into the shell until the earth core was loosened.

A metal blowpipe was used for the final cleaning. It was 10 inches in diameter and 57 feet long, and the lower 3 feet funneled out to a diameter of 27 inches. The jet pipe was carried down along the outside of the blowpipe and entered the latter through a 4-inch sleeve insert in the side of the funnel. The blowpipe was lifted and lowered several times, causing the funnel to rub against the wall of the tube and thus assist in cleaning it. At this stage the ejected material was usually in small pieces.

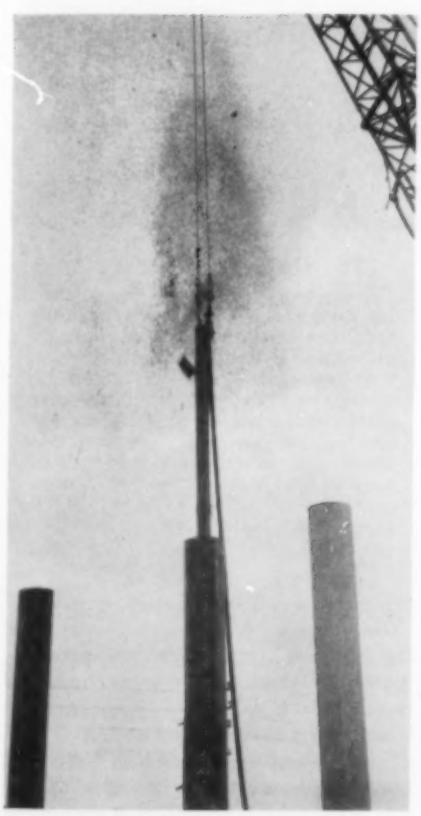
Each shell was checked by the engineering staff to see that a thorough job of cleaning down to rock had been done and that it was ready for the concrete. But before it was poured, the shell was again checked and any water inside was removed. Next, two or three buckets of concrete were dropped into it and the reinforcing, in the form of a cage from 30 to 40 feet long, was placed and held in position by crossbars. Then the remainder of the concrete was poured, making a column to support the bridge and to transmit the load down to the underlying rock table.

Under good working conditions it was possible to blow out and clean four shells in an 8-hour day. The secret of the success of this cleaning operation is a large air receiver and compressors of adequate capacity to supply and maintain the needed pressures.

The designer of the structure was E. W. Wendell, deputy chief engineer of the New York State Department of Public Works. The construction work in the field was under the direction of the author of this article. Bertram D. Tallamy is state superintendent of public works. The state contractor, the Depew Paving Company, sublet the foundation work to the Horton Pile Driving Company of Buffalo, N. Y.

DRIVING PIPE

A 30-inch shell being driven by a Vulcan steam hammer suspended from the 80-foot boom of a Lima crane. Shells ranged in length from 50 to 54 feet and were usually driven to a depth of around 27 feet.



FINAL BLOWING OPERATION

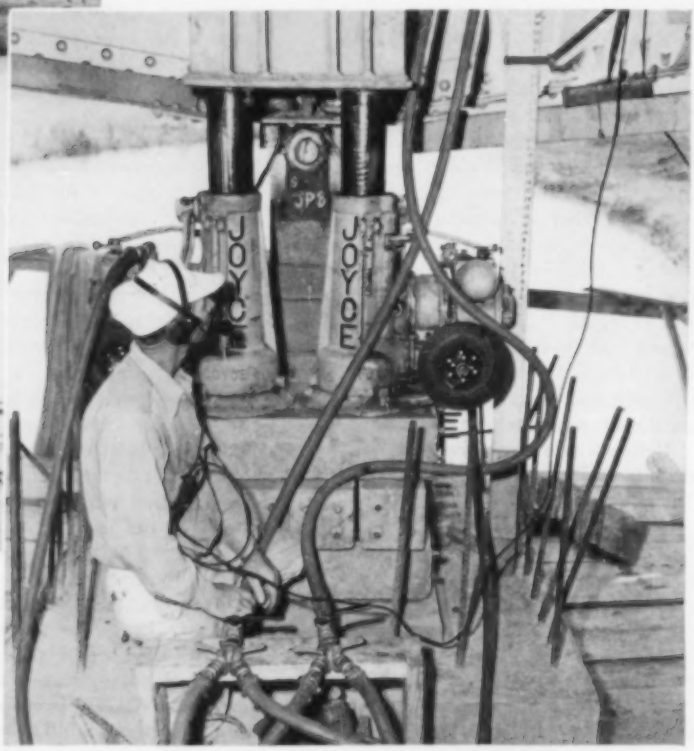
As a blowpipe was alternately lowered and raised in the shell, its enlarged end scraped adhering soil from the interior walls. Meanwhile, air and water admitted through the side pipe under pressure ejected the material and broke it up into small pieces, as shown.

Raising a Bridge with Air Jacks

Unusual Engineering Job Attracts Two Governors and Many Contractors

A PIER DURING THE OPERATIONS

The wooden working platform was suspended from the superstructure so as to ride up with each lift. The jacks and all other equipment and materials, including concrete for progressively building up the piers after each 30-inch rise, were lowered through openings in the bridge deck. After one 4-span section had been raised 30 inches, the jacks were hoisted to the roadway and moved to another section.



100-TON LIFTERS

The operator, fully rigged to carry out his duties, is awaiting an order over the 2-way telephone from the foreman co-ordinating the lift. The black-handled valves near his hands control the flow of air to the pair of 100-ton jacks shown and to another pair at the other end of the pier. In operation, the Siamese valves at the wyes were opened wide so that identical control of each pair of jacks could be effected by the one upstream valve.

AIR-OPERATED jacks raised a 4000-ton highway bridge 17 feet last summer in a notable engineering achievement. The 1500-foot-long, 2-lane structure crosses the Savannah River and connects Lincolnton, Ga., and McCormick, S.C. When erected in 1937 its height was ample to clear a reservoir to be formed by Clark Hill power dam, which the Georgia Power Company was planning to construct at a point downstream from the bridge. However, before the project was undertaken, the U. S. Army Engineers chose the site for a combination power and flood-control dam to be 17 feet higher than the barrier that had originally been proposed. As a result of the change in elevation, the bridge would be engulfed by the backed up waters, and that meant either raising it or building a new one.

The spectacular job did not go unseen or unheralded. The governors of Georgia and South Carolina and highway officials from nearby states were among the spectators who came to see how E. W. La Plante Company, moving contractor of Indianapolis, Ind., was accomplishing the task under a subcontract from Cornell-Young Company, of Macon, Ga. Working with the La Plante crews was Dave Stockman, technical adviser of The Joyce-Cridland Company, Dayton, Ohio, the firm that supplied the sixteen air jacks used and helped to plan the operation down to the minutest detail. Precision teamwork was the key to success once lifting began. Men and machines had to stand up; but in the event they failed, or any piece of equipment, part or manpower was lacking, a chartered plane stood ready to speed what was needed to the scene. The plane was never used.

The bridge consists of four continuous girder sections each 375 feet long and having two full and two short end spans. Each section had to be raised as a unit, and that was done by four jacks of 50-ton size and twelve of 100-ton capacity at ten stations. The smaller jacks were mounted one at each end of the outer piers, while the more powerful units were used in pairs—two at each end of the three intervening piers that supported the continuous spans. The jacks were of the enclosed screw type powered by Ingersoll-Rand rotary air motors that are an integral part of the equipment.

But before actual lifting could be started there was much preparatory work to be done. Holes were cut in the concrete deck slab of the bridge through which the jacks were lowered on to the piers by a truck crane. Short I-sections were welded to the undersides of the end transverse floor beams of each span to serve as bearing blocks or jacking pads, and similar sections were welded between the lower and upper transverse beams to tie them together structurally. The bearing members were placed as close as possible to the bridge shoes and braced to prevent them from kicking out. While these operations were in

progress, hundreds of 7½-inch square, reinforced cribbing blocks of varying lengths were poured for insertion both under the bridge shoes and the jacks as the superstructure rose.

Lifting by all sixteen jacks had to be done not only simultaneously but in unison and was carried out in 7½-inch increments or runs in ½-inch steps. This called for precise timing, and was maintained by a 2-way headphone communication system connecting the controlman at a central station on the bridge with all the jack operators. In addition, each of the latter could check the progress of the upward movement by a unique gauge board fastened vertically to his pier and an indicator arm attached to the bridge.

The procedure was as follows: When a 4-span section had been raised ½ inch, and every crew member had reported that fact to the controlman, the latter gave the order for the next ½-inch lift. This was continued until a 7½-inch run had been completed. Then a row of concrete blocks was slipped beneath the bridge shoes. The jacks, which were clamped to the bearing blocks so that the lower ends moved upward, were then retracted, leaving sufficient space below them to insert cribbing, ready for the next lift. These operations were repeated until the section had been elevated 30 inches in 7½-inch increments. As a precautionary measure against jack failure while hoisting was in progress, a series of ¼-inch steel shims was placed under the bridge shoes to hold the load, though jacks of the type used are designed to do that even when the air supply is cut off accidentally.

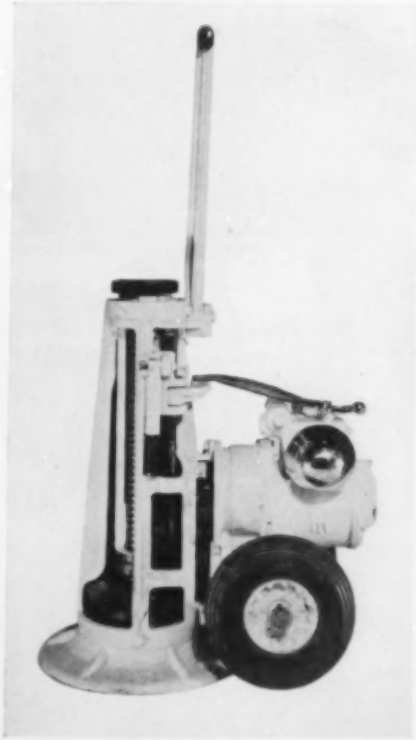
It generally took from 25 to 30 minutes to finish a run (7½ inches), with most of the time spent in blocking up. Three surveyors from the Georgia Highway Department constantly checked line and grade while lifting was going on, and the velocity of the wind was measured by an anemometer. No jacking was done when it exceeded 15 miles per hour. Compressed air was furnished by a 500-cfm portable compressor discharging into a 4-inch pipe that extended the length of the bridge and did duty as a receiver. It was delivered to the motors at 90 psi pressure by hose lines passed down through the deck. There was but one jackman on each pier. Therefore, to facilitate operations, each pair of 100-ton jacks was served by two air lines attached to a "Y" connection so that both could be controlled by a single valve.

After a section had been raised 30 inches, that phase of the work was temporarily halted and the jacks were hoisted to the deck and transferred to another section to repeat the performance. Meantime, the piers of the heightened section were built up by a 30-inch lift of concrete, which was poured in steel forms and embedded the cribbing blocks. In preparation for this operation, dowels had been inserted in vertical holes drilled into the piers to tie the old to the new concrete. By the time the latter had set sufficiently to carry the load, the crews had jacked up the three other sections and were ready to return to the first one to start the hoisting cycle over again.

With one lane of the bridge made impassable by the contractor's equipment, single-lane traffic was maintained day and night except while lifting was in progress, sometimes involving a wait of as much as half an hour. It was controlled by signal lights placed at the ends of the bridge and operated manually from a central station on the structure. As the difference in elevation between adjoining 4-span sections never exceeded 30 inches, temporary timber ramps sufficed to negotiate the grade. But at the approaches it was necessary to construct hinged ramps supported by adjustable bents to take care of the total rise of 17 feet.

HALF UP — HALF DOWN

In the over-all view of the bridge at the top, the two sections on the left were jacked up 30 inches higher than those on the right. While equipment was being moved and made ready for raising the next section, traffic passed over a prefabricated ramp at the offset joint, as shown in the lower picture. Clearing of the bottom lands in preparation for inundation by Clark Hill Reservoir had begun when the general photograph was taken.



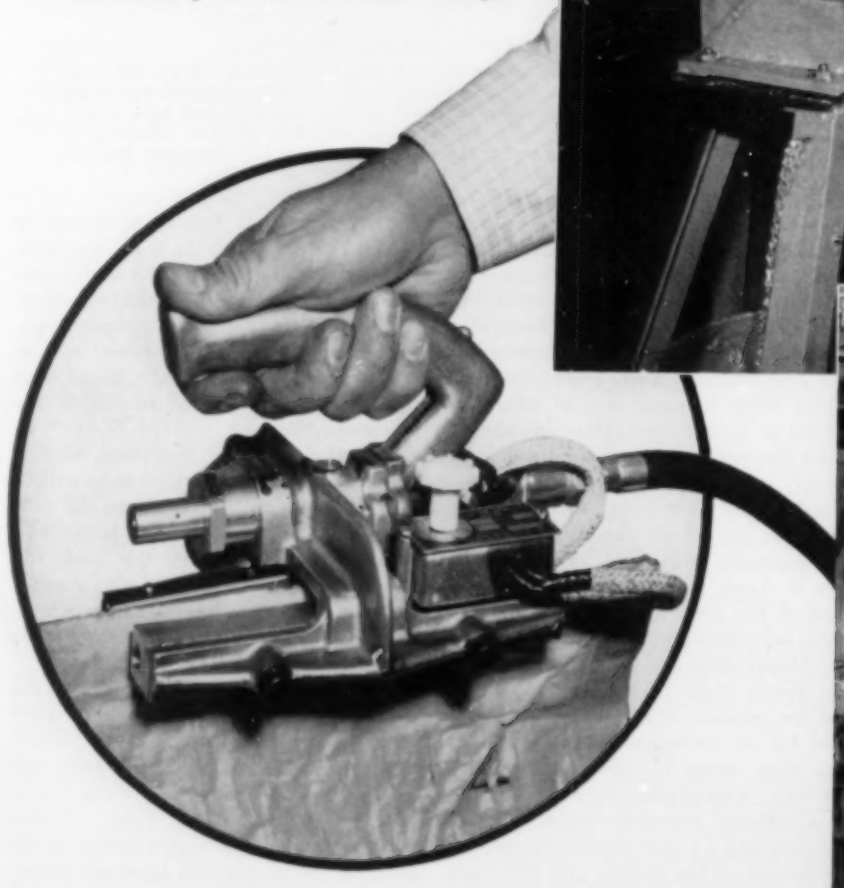
MIGHTY MITE

View of a cutaway model of one of the Joyce-Cridland jacks that raised the 4000-ton bridge. The first short housing to the right of the exposed gear train contains a gear-reduction assembly that is connected directly to the shaft of an Ingersoll-Rand Multi-Vane reversible air motor in the extreme right housing. Through this sturdy and compact system of gears the 15.6-hp, 3250-rpm motor imparts a steady 100-ton lifting force to the jack shoe. Each jack weighs 630 pounds.

An air motor mounted in a welded-steel fixture is shown at the right driving a cutting tool in the Northrop Aircraft plant at Hawthorne, Calif. It saves a great deal of time in trimming ducts and other plane parts that are assembled with welding equipment. A small guide near the tool enables the operator to align the flange of each part so that cuts can be made with maximum speed and accuracy as he maneuvers the work by hand.

●

Numerous products are now packaged in heat-sealed bags of cellophane, pliofilm, foil, or similar materials. For closing containers that are too large to bring to a stationary sealer, Globe Heat-Seal, Inc., of Los Angeles, Calif., sells the portable Aero Seal-It shown below. Weighing 4½ pounds, it has 6-inch jaws that are clamped by air power to exert the necessary pressure, which can be adjusted as desired. Thermostatically controlled heat is provided by an electric element. The unit runs on shop air at from 25 to 125 psi.

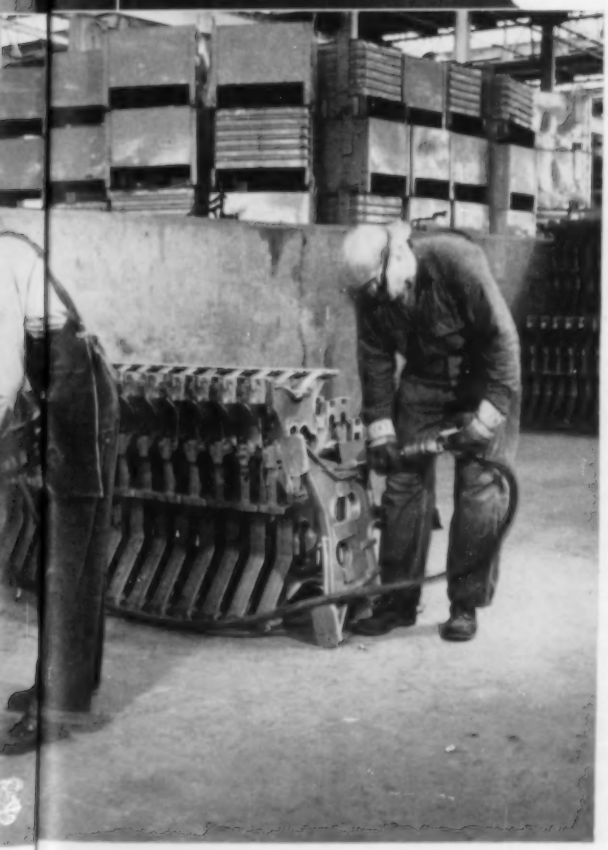


COMPRESSED AIR AT WORK

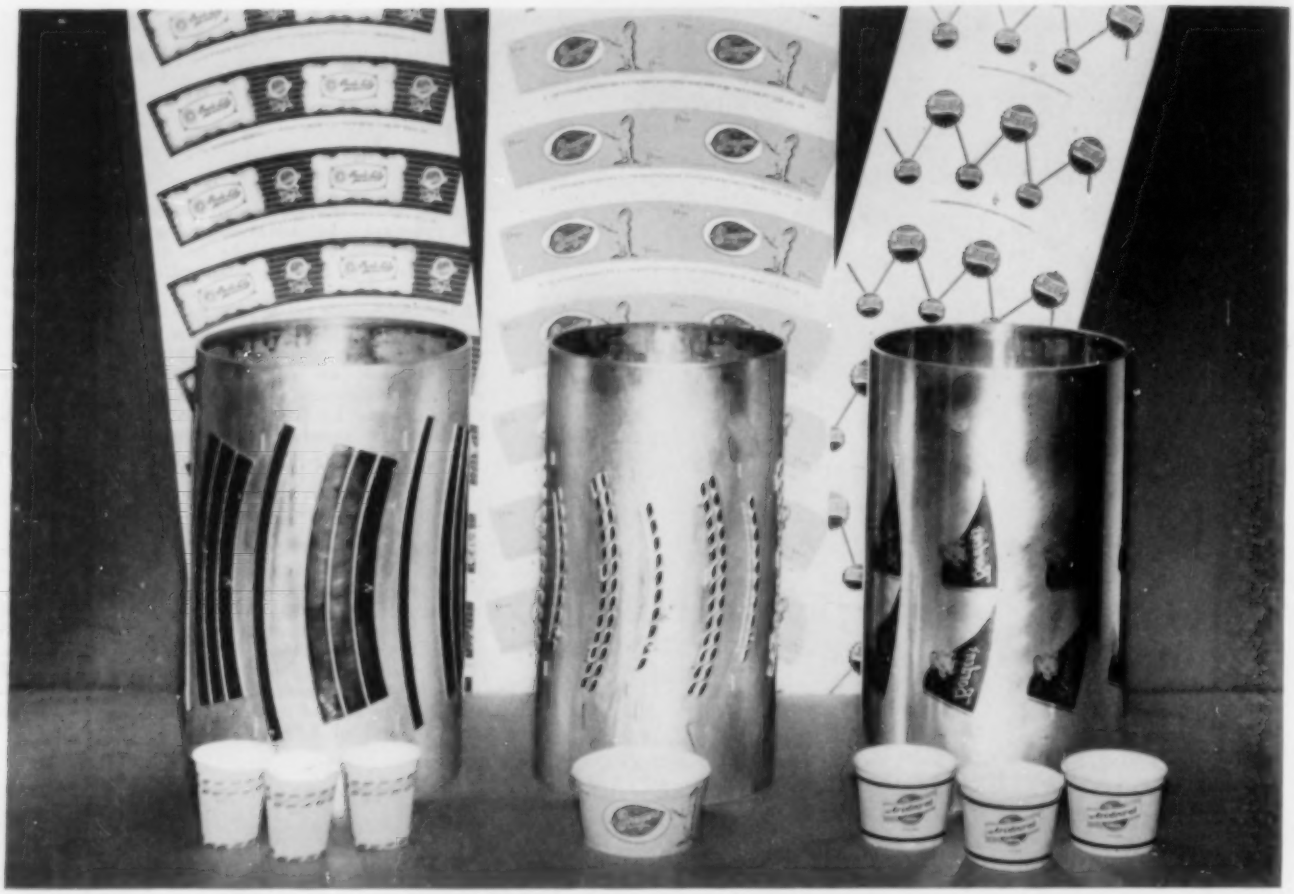
George W. Holcombe is shown at the left with the pressure-oiler attachment for tilt-table routers that he devised while on his job at Texas Engineering & Manufacturing Company, Dallas, Tex. Pressure applied by air taken from the plant line forces oil from a quart-size glass container through flexible tubing to the router head, where it issues as a mist. Cutting oil was formerly brushed on the work rather than on the cutter. Holcombe's development reduces the routing time by 12½ percent and more than doubles the service life of cutters.

●

To enclose a stream running through the Cleveland, Ohio, zoo, the Curro Construction Company erected the arches shown below of Republic Steel Corporation's Toncan-iron sectional plate. Five men established a production record when they assembled 39 plates in 2½ hours. The bolting was done with an Ingersoll-Rand Size 534 air-operated impact wrench, as illustrated. The arches have a rise of 9 feet 3 inches and a span of 18 feet.



The men shown at the left are removing burrs and sharp edges from cast-iron frames for full-fashioned hosiery-knitting machines under construction at the Textile Machine Works, Reading, Pa. They are using Ingersoll-Rand Multi-Vane air-operated grinders and wearing Willson coverall goggles with hardened lenses to protect their eyes from injury. Note the cleanness of the working area, which is in what is rated as one of the world's finest foundries.



CYLINDERS, PRINTED STRIPS AND CUPS

The magnesium cylinders bear three of the many designs that are printed on Dixie cups. On the center one is the pattern that appears on the drinking cups shown in the left-foreground. In the rear are sections of long strips of paper, printed and ready for feeding to cup-forming machines. It will be noticed that the designs run across the strips and are curved. The containers in the center and on the right are for packing ice cream. The Breyer design on the center one is also on the paper strip behind it.

Printing from Magnesium Cylinders

Pennsylvania Photoengraving Firm Develops New Cost-cutting Process for Paper-cup Maker

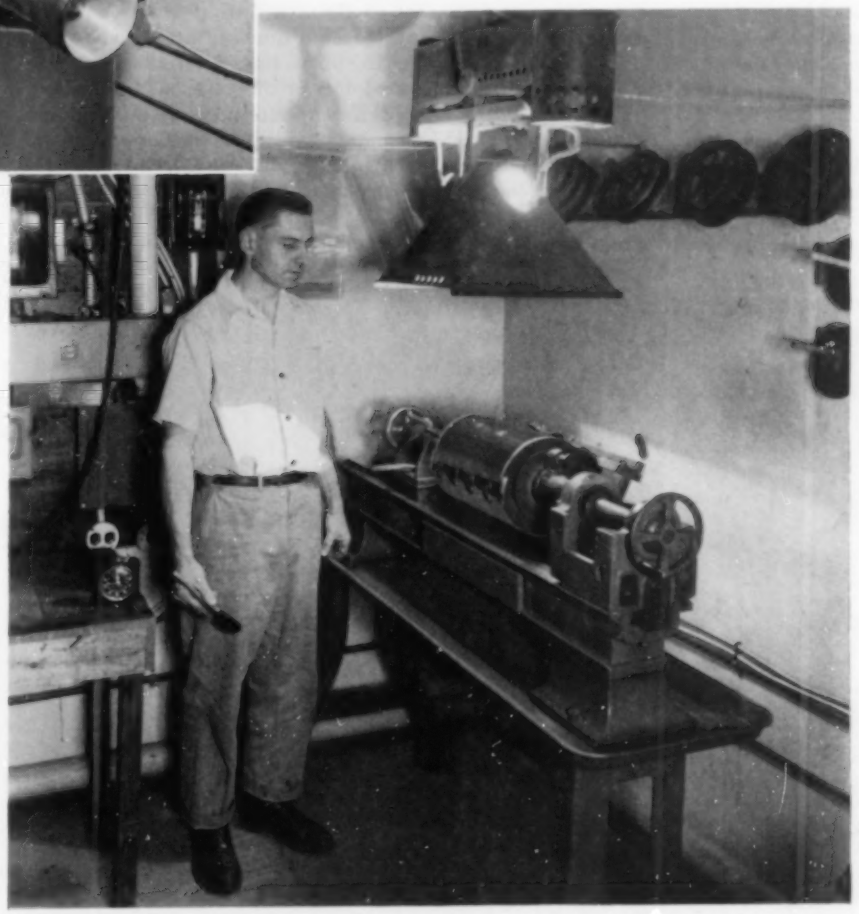
C. H. Vivian

AMERICA is the "printingest" nation that ever was. We not only print books, newspapers and magazines galore, but also put words and pictures on just about every box, carton, can or bottle containing goods offered for sale. Even a box of breakfast food is nowadays resplendent in colored ink. The printer is apparently the merchandiser's ally.

Our penchant for symbols, designs and curlicues far exceeds all practical needs. We just naturally like graphic decorations. Since we do so many kinds of printing on so many different types of surfaces it is no wonder that new ways of doing some of it are continually cropping up. The innovation to be discussed here is an engraved magnesium printing cylinder trade named Magnasleeve. To make the account more understandable to those readers who were not baptized in printer's ink, or who have never watched furtive type lice frisking in the compositor's cases, we will detour briefly into a review of a few basic printing techniques.

Since the Chinese introduced the art of printing around the year 868, innumerable ways have been devised for transferring images from type or plates on to paper. Before movable type was invented in the fifteenth century, both words and illustrations, in China and Europe alike, were carved in wood by hand, using a block for each page. Books printed from them were known as block books. The terminology has lingered in England, where wood-mounted engraved metal slabs from which most illustrations are now reproduced are still called blocks. In this country we refer to them as plates or cuts.

Printing presses of a sort were introduced in the sixteenth century. Now there are many types, each designed for a specific kind of work. The principle of the original flat-bed press is still widely applied. As the name implies, type and illustrations, if any, are assembled in a flat form and paper is impressed on its inked surface by a roller. This magazine is produced on presses of that type, up to sixteen pages being printed



TRANSFERRING DESIGNS TO METAL

As the sleeve is revolved at a controlled rate, the workman pictured at the left pours a light-sensitive solution over it. When dry, the sleeve is mounted on the transfer machine shown in the other view, and the photographic negative of the subject to be reproduced is placed on it, special means having been devised to hold it in exact position and in close contact with the cylinder. The rays from the overhead arc light pass through clear parts of the film and render the underlying sensitizing compound insoluble in water. Intervening areas under opaque sections of the film are not so affected and can be washed away, leaving the photographic design imprinted on the metal. By turning the cylinder a predetermined degree of a revolution and repeating the procedure, the image can be transferred several times from the one negative.

at a time and then folded into what is termed a "folio." Several folios inserted in a cover, stapled and trimmed make a finished magazine.

For some kinds of printing it is desirable to use cylindrical plates. The paper can then be fed continually from a roll, and this permits attaining high speeds. Metropolitan newspapers are turned out in this manner, and huge quantities can be printed quickly. Several steps are required to get the type and illustrations on the cylinders.

Machine-set type and conventional engravings are first assembled in flat page-size forms and locked up. An impression is next taken of each page in plastic or moistened papier-maché which is dried and becomes a mold or matrix. This is curved to conform to the arc of the press cylinder and a casting is made from it with molten metal that is predominantly lead. The resulting stereotype, as it is termed, reaches approximately halfway around the cylinder. It and a mate are locked opposite each other, and other pairs are similarly arranged to extend the full length of the cylinder. With multiple cylinders thus assembled on the press, paper fed automatically from several rolls is printed, collated, folded and cut, complete issues emerging at a rate of hundreds per minute.

These presses are costly, too much so in fact to be utilized except where time is of paramount importance. For that matter, stereotypes are hardly suitable for printing on stock other than newsprint, which is so soft and absorbent as to compensate for minor irregularities in the metal castings. Gravure presses, which also print from rolls, are likewise too expensive for many kinds of commercial printing.

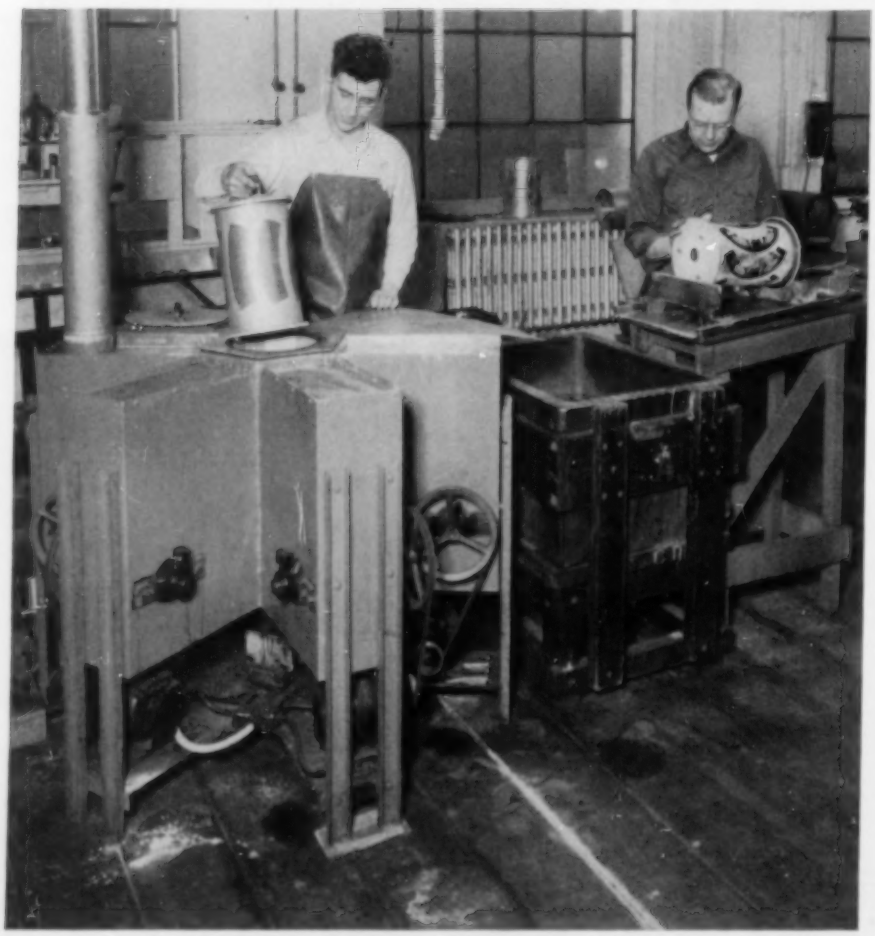
To obtain the advantages of printing from cylinders without spending large sums for equipment, many establishments mount electrotypes on cylinders that can be used on simple, relatively inexpensive presses. An electrotype is akin to a stereotype but of different composition and more precise and durable. To make it, an impression is taken either in wax or a recently introduced foil called Teneplate of the surface to be reproduced. This is placed in an electrolytic bath, and a thin shell of copper deposited on it. The wax is then removed from the mold, after which the latter is "backed up" with molten lead. After cooling, the plate is trimmed, straightened to insure a level printing surface, shaved to 0.187-inch thickness and mounted either on a wood block or a patent base if it is intended for a flat-bed press. If it is to go on a cylinder, it is curved to the desired arc. To increase the durability of the "electro," it may be coated with a thin film of chromium.

Where a fairly small design is being reproduced, several duplicate electrotypes may be mounted on one cylinder which will, at each revolution, make as many printings of the motif. If there are five of them, for instance, the printer says he is running "five-up." The trick is to curve each electrotype with absolute uniformity so that every part of it will contact the paper with the same amount of pressure. Actually, it is exceedingly difficult to do this, and the pressure must often be unduly increased to make sure of getting impressions from "low" areas. This subjects printing plates and press to abnormal wear and detracts from the quality of the work.

If the job is to be printed in more than one color, there will be a separate cylinder, with its complement of electrotypes, for each one. In order to obtain perfect "register," that is, to have each color fall exactly in its intended place in relation to the other colors, all electrotypes in each set must be mounted with extreme precision on their respective cylinders. An error of as much as a small fraction of an inch in the case of any one of them can mar the appearance of the design and give any conscientious printer a nightmare. It is possible to obtain precision-curved electrotypes, but special equipment and extra time are required to make them and they are consequently entirely too expensive for many run-of-the-mill printing jobs.

Photoengravers and printers have long known that many of the troubles inherent in curved electrotypes can be overcome by engraving directly on the surface of a metal cylinder and printing from it. This is done, in fact, but for many types of printing it has not been commercially practical mainly because of the time it takes to machine the cylinder with the necessary accuracy and then to etch it.

Copper and zinc are the traditional engraver's metals: copper for halftones and zinc for line cuts. A halftone consists of dots of various sizes to give different tones. It is made by photographing the subject through a glass ruled with opaque lines crossing at right angles. This image is transferred to copper, and the spaces between the dots are partly etched away with acid, leaving the dots standing up in relief. The spacing of the lines determines the number of dots or the fineness of the screen. Newspaper plates are generally 65 screen, meaning that there are 65 lines to the inch in each direction. Plates used to print this magazine are 100 to 120 screen. A line cut is not broken up by dots; therefore drawings, cartoons and the like can be reproduced with continuous lines.



ETCHING

The man at the left is about to lower into the central cylindrical chamber of the etching machine a sleeve contained in a holder that seals its open ends. As it revolves in the machine, it will be showered with nitric acid entering through six equispaced vertical slots. This insures the acid striking the design head on and not from a side angle, which would promote undercutting and consequent weakening of the supporting metal. The acid is thrown from the six surrounding compartments by paddles, each of which is driven by a separate motor. The etcher was designed expressly for this service and is patented. The man at the right is examining an etched sleeve to determine whether it needs further acid treatment.

For ten years or more, Floyd Lear, Sr., head of Industrial Engraving Company, Easton, Pa., toyed with the idea of eliminating the headaches of curved electrotypes in the manner mentioned, and through his continued efforts has come the Magnasleeve. His interest originated in a desire to help one of his customers, Dixie Cup Company, solve problems encountered in printing stock for its paper cups. Dixie started business in Easton in the 1920's and more or less grew up with Industrial Engraving.

The first Dixie drinking cups were unadorned, but the management soon realized that attractive printed designs would help sell them. Then the concern began to make cups for merchandisers of ice cream, cottage cheese and other food products, and each firm wanted its name, trademark, etc., to appear on the containers. Today virtually every Dixie cup produced in Easton and four other cities bears a printed insignia of some kind. When it is considered that cups are used once and discarded and that they sell for a small fraction of a cent each, on an average, it will be obvious that inexpensive printing is a necessity in their case.

Actually, Dixie has several kinds of presses, including gravure units that cost around $50,000 each, but finds it economical to stick to simple presses and cylindrical plates for a considerable amount of its work, especially where runs of intermediate size are concerned. It experienced the usual troubles with electrotypes, however, and as the supplier of the original plates Mr. Lear naturally learned about them.

In an effort to do something about it, Mr. Lear first tried etching a brass cylinder, and while this was technically satisfactory, it was not practical, mainly because the preparation time was too great. He also attempted to etch a thin sheet of copper and stretch it around a cylinder. That, too, proved feasible but not economical. His experiments convinced him, however, that the idea was sound and would probably work commercially if a metal could be obtained that would machine and etch easily. This metal he eventually found in magnesium.

Magnesium is, of course, a lightweight "wonder" metal that has won attention fairly recently. It was virtually unknown in commerce until 1922, and for a good many years thereafter the Germans were the only ones to do much with it. They were, in fact, the first to use it for photoengravings, but it is not of record that they made cylindrical plates.

During World War II, Dow Chemical Company built several American plants to turn out magnesium primarily for military purposes, and at the end of the

conflict found itself with plenty of production facilities but few customers. To develop new outlets for the metal Dow investigated possible civilian applications which, in the light of the German experience, included printing plates. In the course of this work it produced an engravers' alloy that contains approximately 98 percent magnesium and is now known as Zomag. It not only etches smoothly but also much faster than any other metal used in the graphic arts.

Having followed Dow research closely, Mr. Lear and his three sons, who are in the business with him, arranged to get a cylinder for trial etching and subsequent test run in Dixie's Easton printing plant. As no facilities were then available for extruding magnesium, Dow machined a cylinder out of a solid block. Industrial engraved it more or less by makeshift means because equipment for doing that had not yet been devised, and turned it over to Dixie. Before being put on the press it was chromium-plated, as is customary with electrotypes, in order to increase its wear resistance.

The results of the trial were so successful that Dixie asked for additional cylinders, and six more were made. By that time the Lears were satisfied that they could produce them in quantity at a reasonable cost and had begun to make rough designs of machinery to expedite the various operations involved. On the strength of what had been discovered, Dixie ordered $30,000 worth of electroplating equipment so as to be prepared to chromium-plate the forthcoming cylinders.

During the two years that have intervened since the work was started, a floor in Industrial's building has been given over to the new product; much special equipment has been developed, built and placed in service; and the operations have been well organized. Cylinders or sleeves now come out of the shop at the rate of 30 or more weekly.

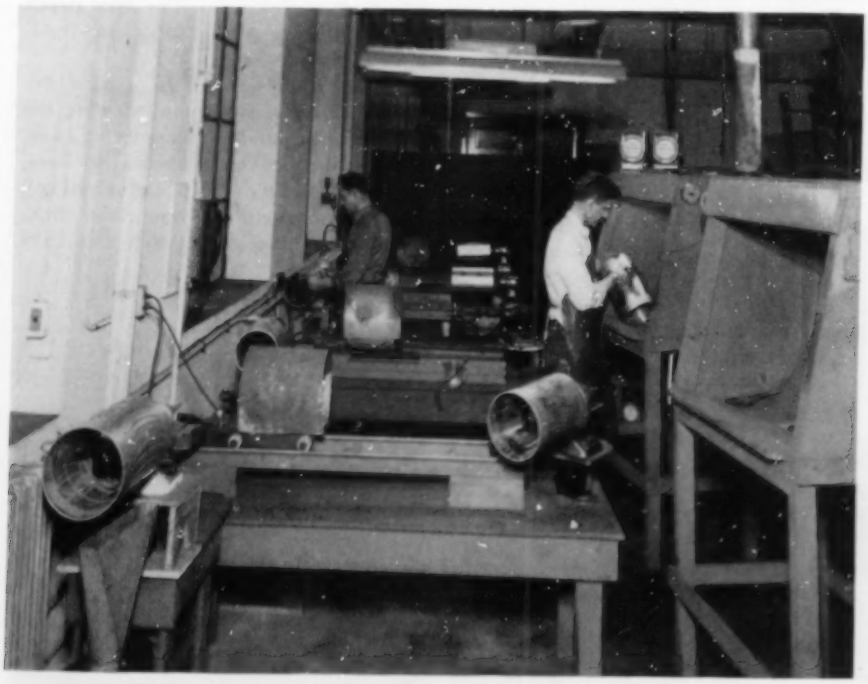
Meanwhile, Dixie's troubles with electrotypes have virtually vanished. Because the magnesium cylinders are truly round, and all areas on the printing surface are of equal "height," they print evenly and sharply without the application of abnormal pressure. "We print now whereas we used to emboss," comments Harry Steiner, in charge of the company's printing.

Another advantage is the important time-saving factor. To change a sleeve on a cylinder requires about fifteen minutes, as against around three hours when electros were used. If a 3-color job is concerned, three cylinders are needed, and the total time involved becomes 45 minutes as compared with the previous nine hours. To take off the snugly fitting sleeve, four screws are removed from an end retaining plate and the cylinder-sleeve assembly is revolved slowly over a gas flame on a simple fixture. In a minute or less the magnesium expands so that the sleeve is loose enough to be pulled off by hand but still not too hot to cause discomfort to a man wearing thin cotton gloves. In similar fashion, the replacement sleeve is heated slightly, then slipped onto the steel cylinder, where it cools and contracts. The time saved is, of course, added to press running time, thus increasing production.

When it was known that there were to be re-runs of a particular design to fill repeat orders for cups, the electrotypes were often left on the cylinder or cylinders concerned to prevent time-consuming removal and replacement. However, so many customers reorder periodically that this practice, had it been followed in all cases, would have tied up hundreds of cylinders, representing a sizable investment. Magnasleeves can, as we have seen, be set aside until needed again and then slipped quickly onto a cylinder. Consequently, no extra cylinders are now required.

Magnasleeves also have solved registration problems because each engraving is positioned with accuracy and can't move. When electros were placed on a cylinder it was always necessary to make adjustments to get them correctly located. Each time they were shifted, the press was started and a few impressions run off to observe the result. In the aggregate, a good deal of paper was wasted; but the sleeves have put an end to that.

Finally, there is the advantage of longer service from magnesium cylinders. Because of surface irregularities and distortion caused by forcing them into position, electrotypes could not run with the light, even pressure that now suf-



POWDERING

Five or six exposures to the acid bath are required to etch the magnesium to the specified depth of forty one-thousandths of an inch. Between "bites" the design is coated with an acid-resisting resinous material called Dragon's Blood. Most of it formerly came from certain species of palm trees native to the Far East, but when the supply was cut off during World War II a synthetic substitute was developed. In the form of a powder, it is brushed on (man at right), after which the cylinder is heated by gas in one of the short tunnel sections mounted on the tables. Heating melts the powder, giving the top and side edges of the etched portions a coating that cools into a protecting film. Cooling is expedited by revolving the sleeve and exposing it to a blast of air (close-up at the right).

FINISHING A SLEEVE

As in the case of all types of photoengravings, the etched cylinder is scrutinized for defects by a skilled workman with the aid of a magnifying glass. Using hand tools (note those on the stand at the left), he removes surplus metal, sharpens lines and performs other finishing operations.

fices, and wear was therefore relatively rapid. A few million impressions was considered good, whereas runs of 15 or 20 million are not uncommon now. Conservatively speaking, Magnasleeves will outlast electros three to one, according to Mr. Lear.

Dixie has a few presses from which cylinders cannot be readily removed, and in the past electrotypes were put on and taken off with the cylinders in place. To service these units with Magnasleeve plates, a sleeve is produced in the ordinary way and then cut into individual-design sections. Being parts of a true cylinder, these plates print evenly. Industrial is now exploring the possibility of using such sectional plates in other fields, and Mr. Lear believes that they have a bigger future than complete cylinders.

Industrial now turns out Magnasleeves for printing cup designs from 3- to 12-up and in one, two and three colors. Finished cylinders are of nine different sizes, ranging from 22.5 to 26.25 inches in circumference and from 11 to 15⅞ inches in length. These are made from four sizes of stock, which Dow produces by the extrusion process. As received, the metal has a wall thickness of ½ to ¾ inch.

The first operation is machining to size, and at that stage tolerances are held to one one-thousandth inch. The desired surface smoothness is obtained by using a special tool for the final removal of material, and no polishing is required. The machined cylinders have a wall thickness of 0.187 inch, identical with that of electrotypes, thus permitting them to be used on the press cylinders previously in service.

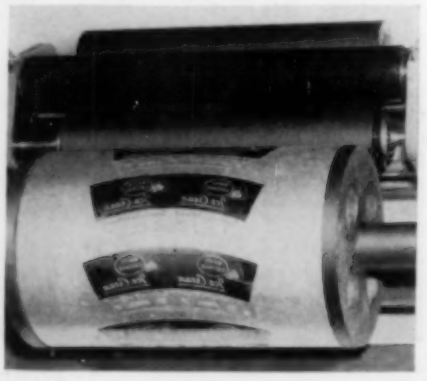
The procedure followed in engraving Magnasleeves is essentially the same as that employed in making conventional flat plates. The design to be printed is first photographed according to the size of the reproduction wanted, with a permissible tolerance of not more than 1/64 inch. After the negative is developed, it is placed on a template and indexed for subsequent positioning on the sleeve. It also receives marks to simplify registration and two lines about ¼-inch long that will appear in relief on the finished plate. At the time of printing, these lines make indentations near each edge of the paper strip and between designs. Later, when the strip is fed from a roll to the cup-forming machine, mechanical fingers come in contact with these grooves and insure that the cup will be produced with the design correctly positioned.

The negative is then placed on a magnesium sleeve that has been coated with a light-sensitive solution, and the image is transferred to the metal by exposing it to an arc light for about three minutes on a special rotary fixture. By rotating the sleeve in steps and repeating the process, the one negative suffices for transferring the motif as many times as the job may call for. Means are provided for turning the sleeve the same distance after each image transfer. Where 2- or 3-color designs are concerned, this permits the two or three negatives required to be positioned with precision and assures close registration in printing. (While cup designs are small enough to be duplicated several times on one sleeve, it is feasible, where the nature of the printing job calls for it, to use a design large enough to extend all the way around the cylinder).

Light passing through the negative strikes the sensitized material and renders it insoluble in water, while areas underlying opaque portions of the negative are protected from the light and remain water soluble. This makes it possible to wash away all but the design. After this has been done and the sleeve dried, the latter is dusted with an acid-resisting powder that adheres to the lines or dots of the image that remains.

Then comes etching, which is done with nitric acid in a special machine, which is illustrated. After a short or shallow "bite," the sleeve is removed, washed with water and dried and then brushed in all four directions with a resinous powder known as Dragon's Blood. It is next heated to melt the powder, and the resulting liquid, which forms a solid film after cooling, covers the sides of the lines or dots that have already been exposed by etching, thus preventing undercutting and consequent weakening on the next bite. In all, four or five exposures to the acid are required, with a treatment of Dragon's Blood after each one. The final depth of the etch is about forty one-thousandths of an inch.

During the final process of hand finishing, a skilled workman, viewing the etched surface under a magnifying glass, removes surplus metal, trues up lines, etc. As presently set up, Industrial can easily perform all the operations from negative to finished sleeve in less than an 8-hour shift.



SETUP FOR PRINTING

An engraved Magnasleeve in position on a press. To remove a cylinder, change the sleeve and remount it on a press ordinarily requires about fifteen minutes, as compared with the three hours that were needed to make the necessary adjustments when electrotypes were used for printing. Printing from Magnasleeves is done at paper speeds of 200-300 feet per minute.

THE TIES THAT BIND

More than a billion of them carry the rails that knit American cities together

ONE of the basic requirements of the world's greatest transportation medium is the lowly railroad tie. The public views the opulent and sleek streamliner or the mile-long freight train with a certain degree of awe but gives little or no consideration to a fundamental that means so much to the smoothness of rail travel. It's the ties that do so much to bind the commerce and culture of our great continent—the large chunks of timber 8 and 9 feet long which are the flooring for the earth's extensive railroad systems.

There are nearly a billion cross ties in Class I Railway tracks in the United States and more than 24,000 miles of track with switch and bridge ties. The Santa Fe Railway, for example, one of the country's foremost carriers, has enough ties on the ground to encircle the globe twice if they were placed end to end and still leave a surplus sufficient to make 1200 miles of signposts to guide the way either over the meridional or equatorial circumference of the earth. Or, if it were possible to reclaim these timbers, they would provide the entire population of the United States with a life-time supply of toothpicks.

Wood products represent the largest item of expense in the maintenance of railroads, and the latter, through necessity, have advanced the knowledge and science of timber preservation by careful studies of the factors that affect the service life of wood from the time the green material is inspected until the product is no longer fit for use. Through these scientific pursuits, aimed primarily at lengthening the life span of ties and timbers, the railways have been helpful in promoting the conservation of one of our natural resources.

The history of preservative methods and of the use of treated wood by the Santa Fe harks back to 1885 when the first plant was built at Las Vegas, N. Mex. Various processes and chemicals were experimented with from that time on until 1923, when the line, after approximately one million western-pine ties had been treated, decided on a creosote-petroleum solution. As a further aid in its research work, the road installed a test track at Cleveland, Tex., in 1902. Since then, more than two million ties have been tested under actual service conditions in all classes of track. Records have been kept of each tie, showing the kind of wood, treatment and year of laying as well as of removal. Timber for bridge structures likewise has undergone thorough investigation, and the findings have been recorded.

Railway officials are convinced of the importance of proper purchase specifications and inspections, modern methods

NAVAJO TRACK WORKER

James S. Begay using a pair of tongs to move a tie into position on the Santa Fe line near Winslow, Ariz.

TIE-TREATING FACILITIES

Exterior view of a new tie boring, adzing and incising plant completed by the Santa Fe Railway at National City, Calif., in 1948.

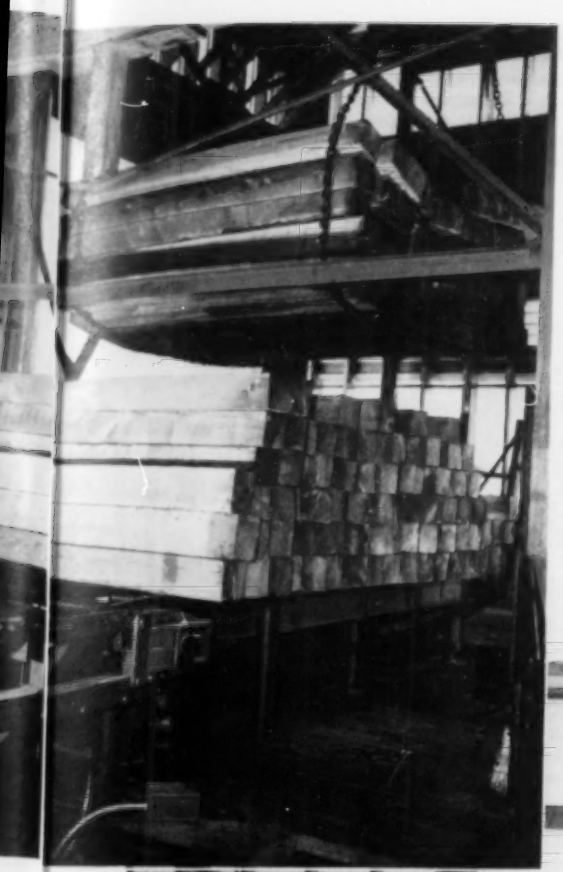
HEAVE HO!

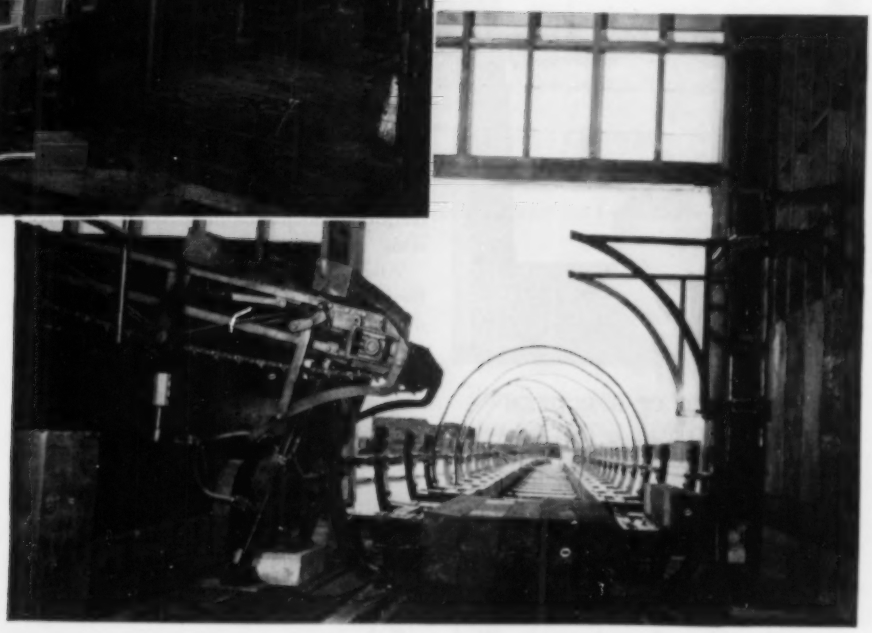
A muscle-straining moment, (above), in the operation of raising track near Flagstaff, Ariz. Worn or defective ties are replaced as rails are brought up to grade. The other picture shows a new tie being moved into position.

of seasoning and protection, boring and adzing of ties and of the preboring and framing of timbers prior to treatment. Men trained in the preservation and care of timber, and who are on the staff of the manager of the system's treating plants, coöperate in selecting the ties that are to be removed from the track, thus insuring a standard method of tie renewal. These experts also choose timber and piling for bridge construction and, together with bridge and building foremen, periodically inspect structures to prevent damage from termite attack and decay by the application of protective measures.

During the first ten months of 1950 more than 80,000 ties were examined to determine the reasons for their removal from tracks. Splits, shattering and plate cuts were responsible for most of the renewals, while 3.8 percent was attributed to decay. An idea of the reduction in the number of cross ties required to maintain the Sante Fe's 20,722 miles of track is given in a survey of the life span of ties covering different 5-year intervals from 1899 to 1948. From 1899-1903 to the 1944-1948 period, the average service life of ties increased from 14.39 years to 37.48 years. As a result, the average renewals dropped from 211 per mile on all types of track in 1899-1903 to 81 per mile during 1944-1948. A recent bulletin shows that there are 330,612 miles of Class I Railroads in the United States and that the average tie replacement for the past five years has been 112 per mile. This indicates that these lines will need a total of 37,028,591 ties annually for purposes of renewal.

An attempt is being made to place enough ties in track of all classes to support the tonnage that may pass over it at varying speeds. Large ties, spaced close together, are used on main lines where traffic is heavy and fast. Where it is lighter, ties are laid farther apart. Hardwood ties are considered stronger and tougher than those of softer woods





IN AND OUT

Most ties were once hewn in the woods where the trees were felled. Now they are commonly sawed in mills and later incised to receive rail-bearing plates and bored if screw spikes are to be used. In these views ties are being fed to (left) and delivered from the incising machines in one of the Santa Fe plants.

and, as a consequence, are to be found principally on curves because of their superior spike-holding properties. In recent years, however, they have become more plentiful and are being used extensively on main lines.

Tie plates of proper size and design are of importance in protecting ties against mechanical wear. The Santa Fe utilizes 8x13- and 8x14-inch plates of improved design with new rail installations and is conducting a study of tie pads, cutting of plates, various materials to be placed between plates and ties, as well as of spikes, rail fastenings, cutting of the entire tie and incising of gum and oak ties. In heavy traffic, it is pointed out, both soft- and hardwood ties fail faster mechanically with small tie plates than with the 13- and 14-inch size. The Santa Fe and other railroads control the splitting of ties by means of metal dowels.

In house and sidetracks, branch lines, and in many localities also on main lines, the tie plates, which go under the rails, are punched for 4-line spikes. It is standard practice to use only 2-line spikes at a time, one on the inside and one on the outside of the rail. This permits driving spikes into the two unoccupied holes when the holding power of the original spikes fails, thus giving the tie a longer life. Plates 13 or 14 inches long and 8 inches wide with eight holes are standard for main-line track. The plate is fastened to the tie by two spikes and the rail is anchored by two other spikes, leaving four holes for later use when required.

Another important adjunct to railway safety is the transmission of an electric current through the rails for the purpose of operating the signal systems. In order to provide a continuous conductor for the current, abutting rail lengths are joined by soldering a bond wire to them.

The largest tie- and timber-treating plant on the Santa Fe is at Somerville, Tex., where five compression cylinders are installed and three more are to be added. It has a capacity of 5000 ties a day and a working force of 200. Southern pine, oak and gum are principally used: southern pine largely for structural timbers; southern pine, oak and gum for cross ties; gum for switch ties; and southern pine and gum for platform decking as well as for piling and poles. The bulk of the material comes from forest lands in Texas, Missouri, Arkansas and Louisiana.

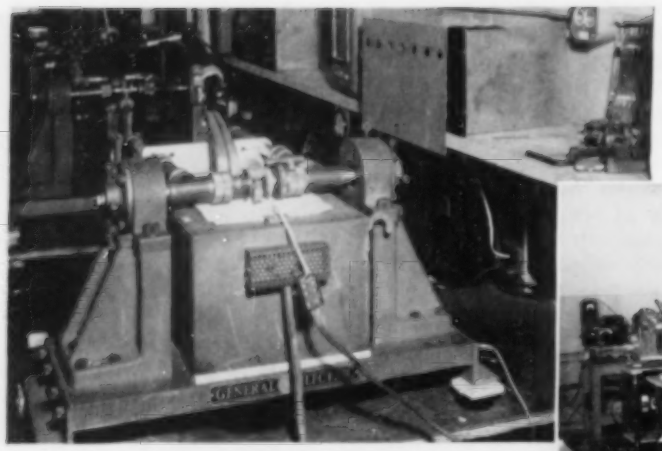
More than 115,000 barrels of chemicals were consumed at the Somerville plant in 1950 for treating the wood. Creosote and creosote-petroleum solutions are used for general purposes and others in limited quantities for special needs. The facilities provided include a large amount of boiler power because steam is required in the case of green ties to penetrate the wood and vaporize the sap so that it can be withdrawn by applying suction to the treatment chamber in which the ties are placed. The creosote or other chemical is then forced into the dried wood by a combination of air and liquid pressure up to 200 psi. Ties are made to absorb from 5 to 8 pounds of the protective fluid per cubic foot, with 6 pounds probably a fair average. When the pressure is released, the air trapped inside the wood expels the excess liquid, but a coating of the preservative that it carried is left in the cells.

A normal supply of ties on hand at Somerville is 800,000 untreated and about the same number of treated ties. These are neatly piled on the 310 acres of the plant, which stretches for a distance of nearly 2 miles along the right-of-way. Particular attention is paid to the protection of these valuable stockpiles. The grounds are kept free of extraneous materials, and sprinkler systems and a systematic patrol are among the elaborate fire-prevention measures instituted.

Timber preservation has occupied the attention of experts for many decades and has led to the expenditure of vast sums by railroads. That these studies have borne fruit is proved by the fact that the life span of ties has been increased from 10 years to 30 years at a great saving not only in cost but also of our timberlands. Experiments are now being made with chemical pretreatment and the recently developed vapor-drying process.

The price of ties, chemicals and other materials required in operating railroads has gone up considerably. Standard treated ties for main-line traffic have recently been quoted at $3.38 each, to which should be added a labor charge ranging from $1.50 to $2 per tie for installation.

Experts point out that there is no satisfactory substitute in this country for the wooden tie at the present time. Much experimental work has been done with steel and concrete, but there is no justification for using such a tie because it cannot compete with the far more economical, longer-lasting timber tie.



BANK OF TEST UNITS

One operator attends seven fatigue testers (below) at General Electric Company's Schenectady, N. Y., works. The unit at which he is standing is equipped with an electric furnace so that specimens can be tested at elevated temperatures. It is shown at close range at the left.

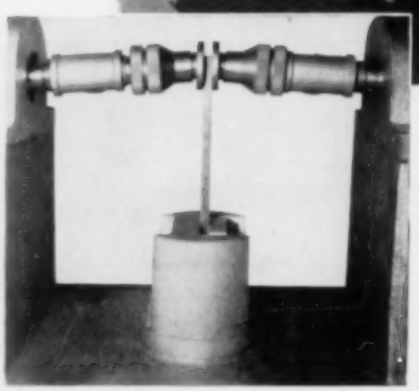
Pneumatic Fatigue Tester for Metals

IN THE never-ending search for better alloys, the research metallurgist and the equipment designer must determine, among a great many characteristics, the extent to which each metal can withstand repeated stress—its fatigue limit. Therefore the ideal fatigue tester would be one which would subject a sample to the identical stresses under the exact conditions it might encounter in service. To approach as closely as possible to this ideal, General Electric engineers designed a reverse-bending fatigue tester based on the pneumatic resonant principle and incorporating some unique construction and operating features.

The apparatus was developed to test buckets of gas turbines manufactured by G-E during World War II. This was necessary because the grain structure, which has a pronounced effect on fatigue strength, varied in different parts of the precision-cast buckets. Therefore only tests of actual buckets would give the desired information. Since then the tester has been refined and offered for sale to metalworking establishments. The machine will produce stresses up to 100,000 psi with about one-fifth as much air as was used in the original unit.

Every alloy has its own peculiar resonance frequency. This means that when it is caused to vibrate it will do so at a certain fixed rate which is usually denoted in cycles per second or per minute. Since it is known that an alloy will oscillate most vigorously (with greatest amplitude) at this natural frequency, service conditions can be more closely simulated and test periods considerably shortened if it is made to vibrate at or near that rate. The pneumatic fatigue tester accomplishes that desired end.

The equipment consists of an air-operated fatigue motor, a telescope, a pressure regulator, and an air valve. The motor has an adjustable air column that is tunable over a vibration frequency range of 50 to 300 cycles per second. This embraces the natural frequency range of practically every alloy that might be subjected to the test. With the lower end of a sample clamped securely in a fixed holder, two small pistons of an opposed-cylinder driving mechanism are rigidly attached to the other end. Then one of seven slides furnished with the tester is inserted in the air column to produce the resonant frequency nearest to that of the specimen.



MOUNTING OF SPECIMEN

The sample is rigidly held at the bottom, while the pistons pass through a drill hole in the upper end of it and are screwed together.

When the air is turned on, one of the pistons is forced outward from its cylinder or nozzle, bending the specimen and pushing the other piston into its cylinder. Since both pistons are mounted in cylinders supplied with air from a common manifold, they will alternately oppose each other at half-cycle intervals and in accordance with the springlike action of the sample. Once it is in motion, the latter is viewed through a telescope, mounted on the tester, to measure its displacement directly in thousandths of an inch. A valve interposed in the air line between the pressure regulator and the motor controls the vibration displacement of the specimen. With that done, and possibly with a slight frequency adjustment of the air-column slide, the test can run its course.

Although pressures up to 90 psi may be used, 20 to 30 psi is generally sufficient to oscillate the samples, and approximately 20 cfm of air is consumed per minute. Accessory equipment includes a special electric furnace with controls for temperature regulation up to 1200°F and a frequency and vibration displacement indicator. When the specimen begins to crack, a sharp decrease in frequency occurs and is recorded automatically; when its resonant frequency drops to a point outside that of the system, automatic controls shut off the tester.

Because it makes it possible to simulate many operating conditions, including testing in atmospheres other than air, the equipment is winning favor in research laboratories such as those of the Allegheny Ludlum Steel Corporation at Waterville, N.Y., where scientists are searching for materials that will withstand operational wear and tear and high stresses and corrosive conditions better than existing ones. An important factor favoring the method of high-frequency oscillation over strictly mechanical means is the speed with which tests can be carried to completion. Another advantage is that one operator can easily handle a number of machines simultaneously. Small unit shapes or parts as well as specimens of materials can be tested by them, and they are also finding increasing use in determining the fatigue limits of nonmetallics.

This and That

Tin-Can Press Devised

The lowly tin can is joining the scrap-producing parade, thanks to the development of a new baling press that crushes them into briquettes averaging 5x5x12 inches in size and weighing around 35 pounds each. A Pittsburgh steel mill has ordered 500 tons of the flattened cans, and the originators of the baling process think they may in time be able to turn out a million tons a year. For the present, they are aiming at making 100 machines and leasing them. The press is manufactured by the Steel Briquette Corporation, of Atlanta, Ga. The first ones turned out are being used by Southern Tin Compress Corporation, of Memphis, Tenn. The compression rams are operated hydraulically. Conveyor belts feed cans to a 24x8-inch chamber and also take away the finished bundles. The baling capacity is 2 to 2¼ tons per hour.

★ ★ ★

Thar's Gold in Gravel

Just west of Denver, Colo., a commercial gravel plant is screening material from a former bed of Clear Creek. There are hundreds of such plants in the country, but this is perhaps the only one that also recovers gold. Clear Creek runs down from Central City and Idaho Springs, scenes of the state's first gold rush. Fine gold carried down by the stream for ages past is disseminated throughout the ground, and floating dredges formerly scooped up the gravel with continuous bucket lines, extracted the golden flecks on mercury-loaded riffles and discharged the residue over the stern. The operations are no longer profitable, however, because costs have zoomed while the price of gold has not. Cooley Brothers Gravel Company, seeing a way to help pay for getting out sand and gravel, first runs the excavated material through such a dredge, then processes it into sizes wanted by its customers. The "take" of gold is about seven cents a cubic yard, which just about pays for the plant's electric power. The dredge, appropriately named Gravel Gertie, originally saw service in Montana and later in the Como section of Colorado.

★ ★ ★

Pneumatic Tire Built Goodyear

The Goodyear Tire & Rubber Company, which now makes hundreds of articles, began business on November 21, 1898, as a manufacturer of pneumatic tires. Its initial products were bicycle and carriage tires and horseshoe pads, and for a good many years tires were the main source of revenue. The company developed the first straight-side pneumatic automobile tire in 1906, and the first tire of that type with cord construction a little later. The first pneumatic cord tire for trucks came along in 1916, and the first pneumatic tire for farm tractors in 1932.

★ ★ ★

Overcoat for Gas Pipe Line

A departure from usual practice was made recently in carrying two 24-inch pipe lines across the bed of the Mississippi River near Greenville, Miss. The lines were laid in a previously dredged trench, and to protect them and weight them down were provided with an outer coat of concrete. The pipe was assembled in 200-foot sections on one side of the river and covered with a coal-tar anticorrosion compound. Steel-mesh reinforcing was then applied, and a cement mixture shot on it with compressed air by the Gunite method. Three Gunite guns were operated for the jacketing. The mixture for each linear foot of pipe contained 35 pounds of cement, 74 pounds of sand and 149 pounds of barium sulphate. The latter, a very heavy mineral, was added to increase the weight, which came to 450 pounds per foot of completed pipe. The lines were laid by Anderson Brothers Corporation as contractors for the Trunkline Gas Company.

★ ★ ★

Flooding Increases Oil Yield

The possibility of recovering petroleum from partially depleted reservoirs by water-flooding is exemplified in the Benton Field of Franklin County, Illinois. Ten years ago the field was producing 33,000 barrels a day, but this gradually fell to 730 two years ago. Water flooding was then instituted, and in 22 months the output totaled a million barrels. Current daily production is running around 7500 barrels, and occasionally it reaches 12,500 barrels.

When flooding was started in 1949 the field had yielded twenty million barrels of crude and was estimated to contain six million more recoverable by conventional methods. Revised estimates are that under flooding practices production will continue for seventeen years and aggregate 21 million barrels. The Shell Oil Company operates a flooding system which is termed the largest of its kind in existence. A complicating circumstance is that an active coal mine is being worked at a horizon 800 feet below the ground surface and 1400 feet above the oil-containing sand. Some of the oil wells run down through supporting pillars of coal left in the mine, and special casing had to be placed in these before water could be injected at a maximum pressure of 1000 psi.

★ ★ ★

Air Cleaves Rock

In the gasification of coal in place underground, compressed air is forced down to supply vital oxygen for combustion. In addition, higher-pressure air can perform another service. In a gasification experiment at Newman Spinney, near Chesterfield, England, holes spaced 33 feet apart were bored deep enough to just extend into the coal seam. It was then necessary to establish communication between the bottoms of the holes so that the air would flow from one to another to burn

"What makes you think I've been stealing ore?"

the intervening coal. This was accomplished by applying sufficient air pressure to one hole to slightly lift the strata overlying the coal and thus permit passage of the air. After the coal was ignited, the pressure was maintained until a channel had been burned through.

* * *

Putting Aromas to Work

Perfume, which has traditionally been applied to attract men, is now also being used to trap lobsters. Perfumers have developed a scent that lures the crustaceans into fishermen's traps, it was recently reported to the American Chemical Society by Paul F. George, member of the chemistry faculty at Case Institute of Technology. The essence is applied to a piece of fish. Mr. George thinks the same idea might help anglers fill their creels. Anyway, scientists are trying out various odors on assorted denizens of the deep to determine their preferences.

Aromas are likewise serving other practical purposes, the speaker divulged. Man-made essences now counteract the malodorous smells of some of the products we use. Certain articles made of synthetic rubber or plastics wouldn't sell at all if they were allowed to retain their natural odors, he stated. Shoe polish, paint, ink, synthetic fibers and numerous other commodities likewise are either deodorized or "doctored" with a pleasing odorant.

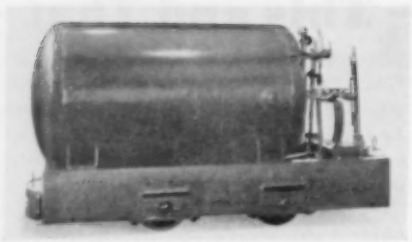
Scenting reagents can even save life, it develops. Learning that sharks never infest waters where there is a dead member of their species, researchers discovered that it is the smell that repels them. They succeeded in duplicating it, and World War II fliers on over-water missions carried the substance and released it if shot down. Observers noted that sharks kept several miles away.

* * *

Mines Use Air-powered Locomotives

It may come as news to many people that there is still a considerable demand for compressed-air locomotives in the mining industry. The fact is that E. Long Engineering Works of Orillia, Canada, has just begun manufacturing them to supply customers north of the border. Up to now they have not been made in Canada, and the mines there have been importing them from the United States where at least two concerns still build them.

The chief favorable points about an air-powered locomotive are its relatively low initial cost and, in gaseous mines, freedom from fire and explosion hazards. Even though its performance is limited, these factors justify its use for certain



services. Some units are designed to store operating air at high pressures, but the Long locomotive runs on 100-psi air and its receiver can therefore be filled at any outlet on regular mine-distribution systems. It is made in sizes with reservoir capacities of from 45 to 82 cubic feet and for track gauges of 18, 24 and 30 inches. A 5-cylinder, 6-hp air motor is incorporated in all units. An intermediate size can, it is claimed, draw a 10,000-pound load a distance of 1000 feet against a grade of 0.5 percent on one charging. Recharging requires about one minute.

* * *

Pipe Lines Move Coal and Ores

Almost any granular or finely divided substance can be transported by pipe line with the aid of either air or water. Materials such as grain, cement or lime that must be kept dry can be conveyed in an air stream. Others that moisture does not harm can usually be moved cheaper by water if an ample volume is available. Two instances where water is being used for rather long-distance pumping of mineral matter have been reported recently.

In Canada, International Nickel Company has set up a 2-way system with a total length of 12 miles for handling concentrated ore and mill tailings. At Creighton, Ont., it treats around 3,650,000 tons of copper-nickel ore annually. Each day it produces, roughly, 1800 tons of concentrate and 8200 tons of refuse. The concentrate is pumped through two 8-inch lines a distance of 7½ miles to Copper Cliff for further treatment. The tailings are pumped through two 13-inch conduits to a disposal area about midway between the two plants. By-product tailings obtained at Copper Cliff, amounting to approximately 500,000 tons monthly, are also pumped to the disposal area.

The entire system is supported on wooden trestlework, some of it 65 feet above ground surface, with all lines sloped for self-drainage in the event of power interruption during the cold winter months when freezing would otherwise be a hazard. All pipes, including a 6-inch water line, are of wood-stave construction. There are five pumping stations on the route. The longest pumping stage is 9700 feet. Enough water is added to the materials to form slurries from 1.28 to 1.48 in specific gravity. The velocity of the flow ranges from 5 to 6 feet per second.

At Cadiz, Ohio, the Pittsburgh Consolidation Coal Company has placed in operation an experimental 12¾-inch pipe line for transporting fine coal mixed with water. Now 8000 feet long, it is to be extended to 17,000 feet and given a year's tryout in moving from 7000 to 9000 tons of coal a day. If the test is successful, the company expects to connect other coal-producing areas to the system and extend it to the Great Lakes. Still farther in the future is the possibility of delivering coal in this way to principal consuming centers within reasonable distances from the fields.

As new as this sounds, it is actually old. In 1895, a subsidiary of the Consolidated Edison Company experimented in New York City with a carrier system for pulverized coal and water. Nothing came of it then for two reasons: there was no use for powdered coal in those days, and the railroads raised a big fuss about it, fearing they might lose freight revenue if the scheme worked.

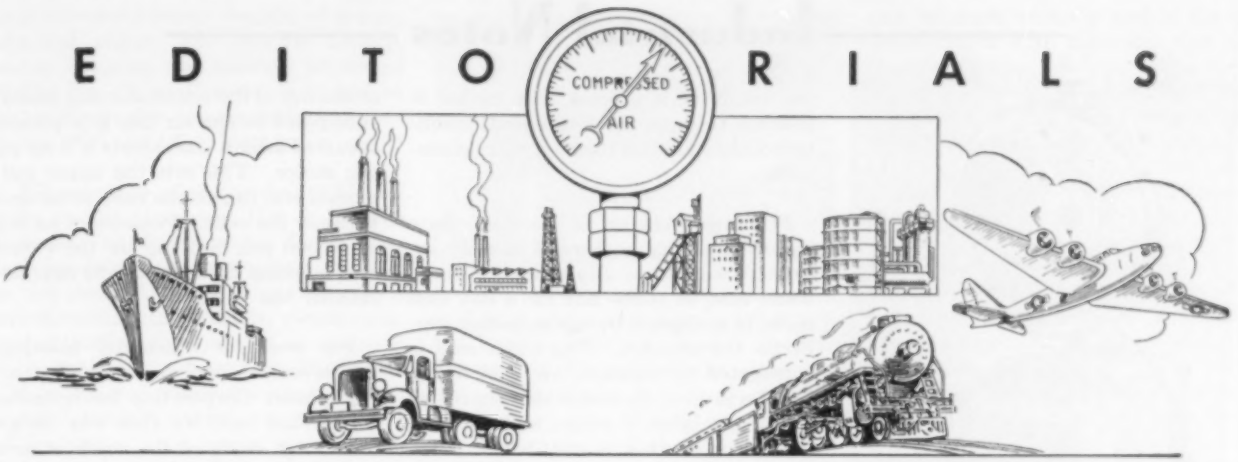
* * *

Highway Vacuum Sweeper

California's famed climate brings troubles to highway maintenance crews. Because people can and do get outdoors a lot, they create an unusual amount of litter. Along the beaches and in the resort areas in the southern part of the state the roadsides are strewn with bottles, ice-cream cups and other trash that is either thrown out of cars or left by picnickers. As the highway department averages only one man to every 7 miles to cope with the problem, a mechanical sweeper seemed to be the logical answer. A suction machine offered for such work was purchased, but it proved to have been designed for handling only paper and leaves. All the material picked up passed through the fan that produces the vacuum, and that member didn't thrive on a diet of bottles and cans. The highway department therefore rebuilt the apparatus so that the heavy refuse could travel past the fan and into a separate container.

The cleaner is pulled by a truck and has a 10-inch flexible pipe that extends almost to ground level on one side. To guide the snout back and forth over a 5-foot strip, an operator rides a chair just behind it and controls it with a handle bar. He has a buzzer connection to notify the driver to stop if anything goes wrong. On one section of a coastal highway the machine recently harvested twelve truckloads or 150 cubic yards of bottles, cans and other litter in three days. The state has made movies of the cleaning operation and will show them as often as possible in an effort to induce motorists to be tidier.

EDITORIALS



WE VOTE FOR THE ROCK DRILL

IF YOU were asked to name the most significant engineering development of the past century, what would be your reply?

Dr. John R. Dunning, dean of engineering at Columbia University, put the question to 32 editors of trade and business magazines and got answers that included 28 subjects. When they were sifted, it was found that advances in the production and use of steel headed the list. It was generally agreed that there could have been little engineering progress without steel and its alloys.

The editors who chose steel named the Bessemer pneumatic converter among the industry's notable achievements. Its invention in 1855 (shared by Kelly in this country) and the introduction of the regenerative principle of steel-making by William Siemens in 1868 were characterized by Thomas E. Lloyd, editor of the *Journal of Metals*, as "the foundation upon which today's civilization has been built." "The steel industry," he said, "is the backbone of both peacetime and military economies in every nation of the world, and those countries without a dominant steel industry are secondary nations from the standpoint of military power. Without steel in huge quantities, made possible by Bessemer and open-hearth processes, modern society could not exist."

Electric power and its application ran steel a close race for first place. Those who favored it, mentioned the dynamo, the great surge of hydroelectric power, steam central-station developments, and the incandescent lamp. Among other innovations that were given serious consideration were: assembly-line production, reinforced and prestressed concrete, the telephone, interchangeable machine parts (some say they date back to Eli Whitney and the cotton gin while others attribute them to Samuel Colt and his revolver), gauge blocks, internal-combustion engines, geophysical prospecting and the general application of geological science to mining, and the tin can.

Also mentioned, mainly by editors of papers concerned with electricity and radio, was the vacuum tube. A few votes were cast for explosives and the mechanical rock drill. If the whole matter is simmered down, it is hard to leave the rock drill out of a leading place. Without it there would have been little steel or other metals with which to create the marvels of the past century. Neither would there be many great dams and hydro-power plants nor tall buildings on rock foundations. The rock drill is, by all odds, a basic tool of the modern age.

CENTENNIAL OF ENGINEERING

THE year 1952 will be a notable one in engineering circles. To celebrate its founding an even hundred years ago, the American Society of Civil Engineers is fostering a Centennial of Engineering. Four other national societies in which electrical, mechanical, chemical, mining and metallurgical engineers are enrolled have united with it to form the Societies of Engineers Joint Council, which represents a combined membership of 130,000. More than 50 other national and international engineering groups have promised their support.

To arrange the celebration, Centennial of Engineering, 1952, Inc., a nonprofit organization, has been formed with headquarters at the Museum of Science and Industry in Chicago, Ill. The museum will figure prominently in the program, with special displays designed to appeal to laymen as well as the technically trained. The exhibits will remain in place for several years and are sure to be viewed by a sizable fraction of the American people because visitors to the museum number three million in a normal year when nothing special is scheduled.

In Chicago, also, there will be a mammoth convocation from September 3 to 13. Symposium sessions participated in by members of engineering organizations from many countries will cover a broad field of engineering and industrial accomplishment in language understandable to everyone. In addition, many individual societies will hold purely technical meetings.

The centennial, state the directors, will aim to make known the contributions of engineers to our national progress; to depict clearly the role of industry with its mass production and distribution so essential to our high standard of living; and, above all, to attempt to demonstrate that an atmosphere of freedom and competition is necessary to maintain or increase the prosperity of the nation. It is expected that a million dollars will be contributed by industrial and manufacturing organizations to finance the celebration.

DON'T WASTE AIR

BENJAMIN FRANKLIN, the anniversary of whose birth was observed last month, wrote in his *Poor Richard's Almanack:* "A little leak can sink a mighty ship." Franklin knew and repeatedly stressed the importance of trifles. If he were alive today and happened to be holding a job in industry he would most likely remonstrate against leaky compressed-air lines and connections.

Escaping gas is always dealt with immediately because it constitutes a hazard to life and property. Even broken or dripping water lines get reasonably prompt attention because their effects are visible and messy. In many factories, however, compressed-air leaks are ignored until their hisses become unbearable or so much air is lost that the required operating pressure can no longer be maintained.

Being invisible, odorless, nontoxic and self-effacing, compressed air is often permitted to dissipate itself extravagantly and expensively. Yet there is no reason why air lines, connections, and valves cannot be kept as tight as gas- or water-distribution systems. Air power is an ever-ready, highly adaptable, effective and tireless industrial servant, but it can be a costly one if it is neglected.

Industrial Notes

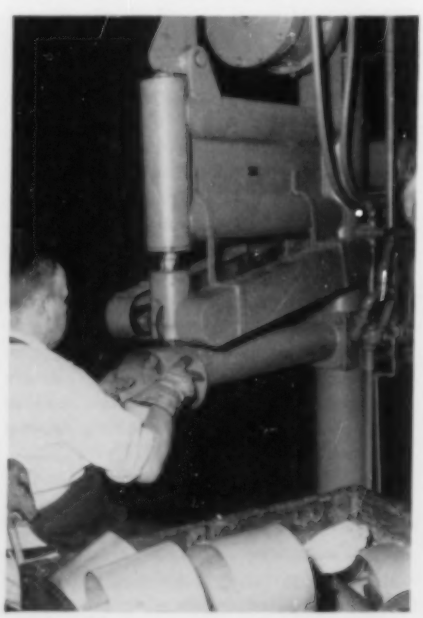
Shown here is a self-contained lamp offered by General Scientific Equipment Company for emergency use. When standing guard, it is plugged into a 110-volt a-c outlet (d-c type available) and lights automatically the instant the regular circuit fails. Powered by a standard 6- or 7½-inch-volt dry battery, its floodlight of 21 candle power is said to provide illumination for many hours—long enough to prevent damage and injury, to carry out necessary plant operations, and to permit making repairs. The lamp proper can be turned in any direction and has a handle on the back of the reflector for portability.

By means of catalytic conversion, the Shell Chemical Corporation expects to recover 13,000 tons of sulphur annually from waste gases at its Houston, Tex., refinery. A unit for the purpose is now under construction there and is scheduled to go into operation around the middle of this year. The output will be used to make sulphuric acid. In addition to conserving a strategic material, the plant will help to solve the problem of atmospheric pollution in the heavily industrialized area.

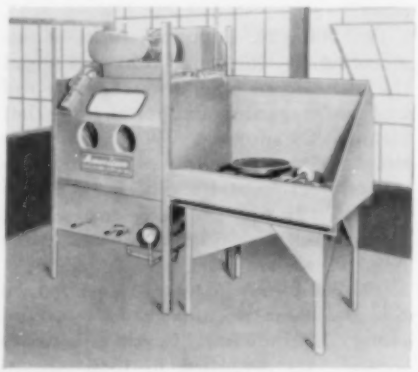
Two lead-clad materials, intended primarily for use in chemical process plants, have been announced by Knapp Mills, Inc. Trade named Ferrolum and Cupralum, they are combinations of lead and steel and lead and copper, respectively, and are expected to find numerous applications in the atomic field as a means of preventing the escape of harmful radiation. Ferrolum is made on a newly developed automatic lead-cladding machine at an appreciable reduction in cost over the hand-clad material, it is claimed, while Cupralum is the result of a process that makes it possible to draw the two metals simultaneously and bond them together chemically.

For men working in the field there is now available a thermos heavily insulated with Dow Styrofoam to keep water cold or coffee hot for a day and more, it is claimed by the manufacturer, Bettis Corporation. The outer wall is corrugated for strength, and two heavy handles protect the removable top cover. Called the Igloo, it comes with or without a push-button faucet, which is inset to prevent breakage. The thermos is made in 1½-, 3-, 5-, and 10-gallon sizes.

One thousand percent increase in production is reported by the Ryan Aeronautical Company through the introduction of a seam roller designed and built by its plant engineering department for the purpose of flattening the seams of stainless-steel sections welded into tubular form to serve as aircraft-engine exhaust components. The work was formerly done by a hand-held grinding tool with the part clamped in a vise. It was a laborious process because the use of filler rods in welding necessitated the removal of considerable metal to obtain a smooth finish. With the new equipment it is possible to weld by Heliarc, which deposits less metal because filler rods are not required. The machine functions as follows: The operator places the cylindrical section, with one of its two seams uppermost, between two steel rollers and depresses a foot valve, thus admitting air at 90 psi into a 10-inch-diameter pneumatic cylinder that lowers the top roll into working position (part of cylinder is shown at the top of the accompanying picture). Interposed in the air line is a pressure-operated switch that starts a 2-hp electric motor. This sets the upper roll in motion and causes the tube to be drawn between the rolls. Pressure of as much as 20,000 psi, built up by the cylinder and machine linkage, can be applied to smooth the seams.



For work for which dry blasting is too severe, American Wheelabrator & Equipment Corporation has introduced a wet-blast machine that was designed after close study of the needs of metal-working, chemical, ceramics and other industries that include precision cleaning and finishing among their operations. Called the Liquamatte, the abrasive mixture is circulated by a pump with a flooded-type suction that always keeps it primed, and compressed air at 80-100 psi pressure gives the slurry an added impulse while blasting is in progress. The machine is equipped with a reset timer that tells the operator when the abrasive mixture should be changed. This is done by an air ejector which blows the slurry out through a hose into a sump pit or drum. Large windows give a clear view of the work, and cool fluorescent lights inside the cabinet prevent baking abrasive onto the glass and obscuring vision. Gauntlets are attached to the armholes so that every operator can wear his own gloves and small parts passed through those openings instead of the doors. The abrasives used range in size from 80 to 2500 mesh and, because of their fineness, do not, it is claimed, alter or make precision-built sections useless. All sorts of dies, machine tools, as well as rubber, plastic and glass molds have been successfully cleaned and finished by the Liquamatte, says the corporation.



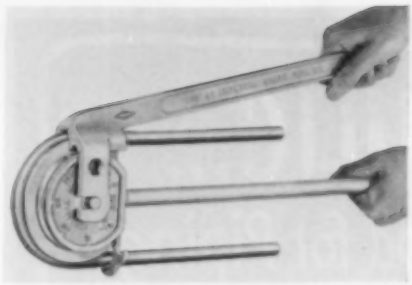
What is described as a safe solution for cleaning machinery and other plant equipment has been announced by Kelite Products, Inc. The liquid can be applied by spraying or wiping and is

said to remove heavy deposits of grease, oils and grime. For periodic maintenance cleaning the solution, known as Kelite No. 28, is diluted. It is said to be nonflammable, noncorrosive and nontoxic. Will not affect good paint.

Fifteen years of cultivation of Hevea trees by the Goodyear Tire & Rubber Company on 2500 acres in Costa Rica has demonstrated that natural rubber of the plantation variety can be grown successfully in the Western Hemisphere and at sufficiently low cost to compete with the output from the Far East. This significant statement was made by P. W. Litchfield, chairman of the board of Goodyear, in a recent issue of his *Notes on America's Rubber Industry*.

Where one machine feeds another, both can be simultaneously protected against tool and die breakage by an electronic instrument made by Brinnell Company. The latter claims that its Dual Channel Protectron "senses" the slightest mechanical overload regardless of the cause (pile-up, misfeed, tool dullness, overhard or oversize stock) and instantly stops both machines before any damage is done. The device can also be used for monitoring automatic equipment through lunchtime, during stock replacement, etc., and thus increase output.

The Imperial Brass Manufacturing Company has announced a new bender for aluminum, copper, brass and other soft, thin-walled metal tubing of small diameter. It has a mandrel calibrated

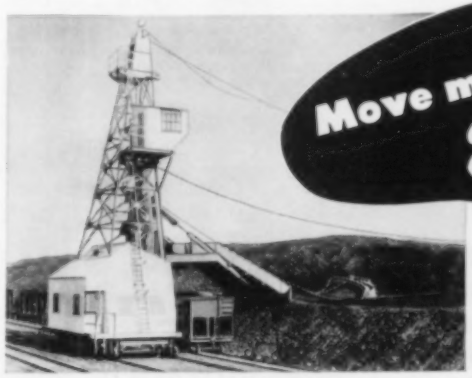


in degrees and a dual-size shoe that permit bending ½- and ⅝-inch (outside diameter) tubes without changing any part. The device is slipped over the tube, and a slide block, with slots in arms to engage pins on the mandrel, is pushed into position. Bends up to 180° can be made with one end of the tube connected or with both ends free. The 2-piece construction also facilitates removal of the device when the bend is completed. Catalogued as No. 362-F, it weighs 3 pounds and is 21 inches long.

Something different in rustproofing materials for metals in transit, storage or during processing is offered by Shell Oil Company. It is in the form of crystals of VPI amine nitrate which, being slightly volatile at atmospheric temperatures, give off vapors that condense and cover the surfaces with a thin protective layer. The powderlike substance is placed in containers in which parts or products are shipped, or is blown into areas where they are tem-

BEFORE AND AFTER REPAIR

Here is an unretouched photograph showing a rough, uneven trucking floor in process of repair with improved Roc-Wood, a material composed of chemically treated hardwood fibers held together by a plastic binder. A product of Roc-Wood Flooring, it needs no underlay, and is said to harden ready for use within 24 hours, to withstand the vibration of machinery, to be skidproof when wet and resistant to most acids as well as to strong brine and cleaning solutions.



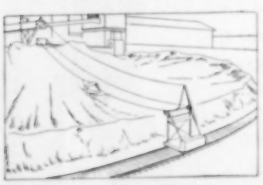
Sauerman Tower Machine using 6 cu. yd. Crescent scraper, handles stockpile at rate of 250 t.p.h. Machine stocks cut the material as discharged on dock from ships and then reclaims to cars.

Move more yardage Easily . . . . at lower cost

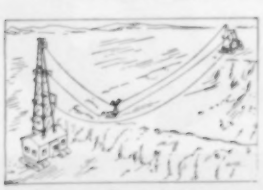
with a

SAUERMAN DRAG SCRAPER

Sauerman Scraper Excavator



Sauerman Scraper Stockpiler



Sauerman Tower Excavator

In a Sauerman Drag Scraper Machine you find a profitable combination of digging power, haulage speed, long reach, simple operation, economical maintenance.

An important exclusive feature of the Sauerman scraper machine is the Crescent scraper. Because of its streamline design, the "Crescent" requires less linepull than any other type of scraper, both in excavating and in conveying. It penetrates hard material with the ease of a plowshare, gathers a full load in a few seconds, then rides its load speedily to the dumping point where it makes an instantaneous, clean dump.

The operator, sitting in a comfortable control station, easily guides the scraper over a large area. Automatic shifting of the tail end of the machine is provided where desired. Power requirement is moderate. Installation and upkeep costs are surprisingly low. Made in a wide range of sizes covering the capacity needs of large and small projects.

Write for Sauerman Catalogs A and E, describing and illustrating the latest methods of using drag scrapers for pit excavation, stripping, pond cleaning, waste removal, stockpiling, etc.

SAUERMAN BROS., Inc.

548 S. Clinton St. Chicago 7, Illinois

Cableway and Scraper Specialists Since 1909

VICTAULIC... The Best Method for Piping!

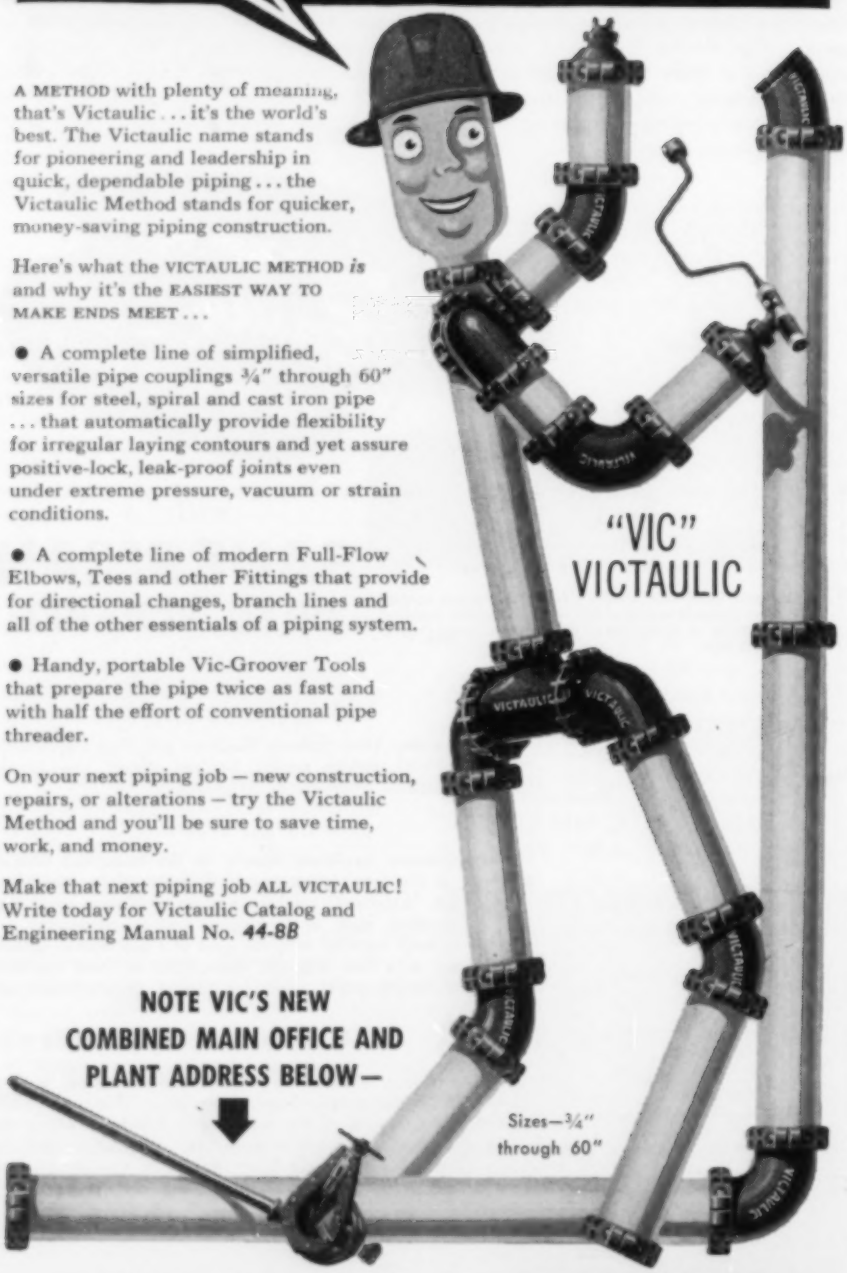
A METHOD with plenty of meaning, that's Victaulic . . . it's the world's best. The Victaulic name stands for pioneering and leadership in quick, dependable piping . . . the Victaulic Method stands for quicker, money-saving piping construction.

Here's what the VICTAULIC METHOD *is* and why it's the EASIEST WAY TO MAKE ENDS MEET . . .

- A complete line of simplified, versatile pipe couplings ¾" through 60" sizes for steel, spiral and cast iron pipe . . . that automatically provide flexibility for irregular laying contours and yet assure positive-lock, leak-proof joints even under extreme pressure, vacuum or strain conditions.
- A complete line of modern Full-Flow Elbows, Tees and other Fittings that provide for directional changes, branch lines and all of the other essentials of a piping system.
- Handy, portable Vic-Groover Tools that prepare the pipe twice as fast and with half the effort of conventional pipe threader.

On your next piping job — new construction, repairs, or alterations — try the Victaulic Method and you'll be sure to save time, work, and money.

Make that next piping job ALL VICTAULIC! Write today for Victaulic Catalog and Engineering Manual No. ***44-8B***



NOTE VIC'S NEW COMBINED MAIN OFFICE AND PLANT ADDRESS BELOW—

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Phone: Elizabeth 4-2141
Victaulic Inc., 727 W. 7th St., Los Angeles 14, Calif.
Victaulic Company of Canada, Ltd., 406 Hopewell Ave., Toronto 10
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27TH VICTAULIC YEAR

The easiest way to make ends meet
VICTAULIC
PIPE COUPLINGS AND FITTINGS

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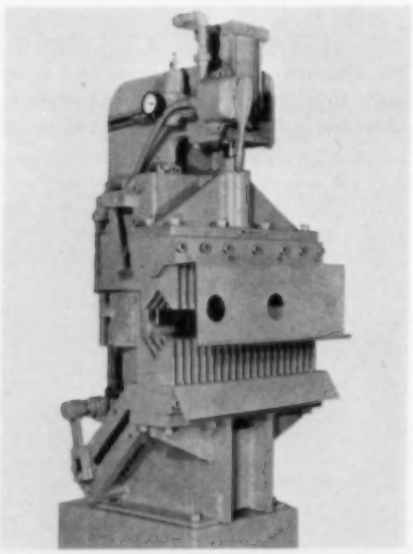
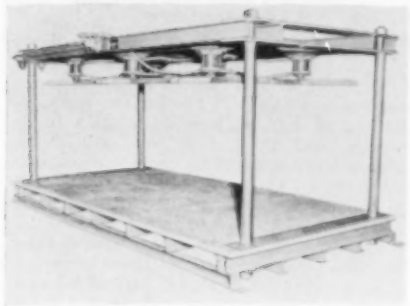
porarily housed. It is claimed that one gram of the crystals will protect one cubic foot of an assembly for as long as a year and that the metal is ready for immediate use. Substance also serves as a corrosion inhibitor in hydraulic fluids and water-soluble paints.

In making radiator, cylinder and similar types of castings it is necessary to use several core rods, and these are frequently bent in recovering them from the finished work. To make them fit for reuse, General Riveters, Inc., has developed a high-speed straightening machine with or without an automatic unloader. It is equipped with an upper and a lower die consisting of a series of ½-inch thick V-blocks between which the rods are placed. The blocks are spaced ¾ inch apart and are staggered so as to fit into one another on the downstroke of the ram, which is operated with air at 80 psi pressure and controlled by a hand valve. Both speed of travel and force of blow are adjustable. The machine is designed for round wire rods ¼ to ½ inch in diameter and 24 inches in length. Longer ones can be straightened by more than one stroke. If an automatic ejector is used, a finger is engaged by a latch just before the ram reaches the bottom of its travel and raised when the ram moves upward, causing four kicker bars to unload the straightened rod. The finger is disengaged by means of a cam, allowing the bars to return to the "down" position. According to General Riveters, the machine without the ejector mechanism handles from 600 to 700 core rods an hour; with it, output is stepped up to 1000-1200 rods.



Among the equipment developed recently for woodworking plants is an air-operated assembly press that facilitates the job of gluing veneer panels to hollow-core door frames. Designed especial-



ly for shops equipped for small-scale production, the flush-type doors are handled in bulk, the number assembled at one time depending upon their thickness. The top platen is surmounted by a group of pneumatic cylinders and is said to exert positive, sustained pressure during the gluing period (7535 up to 96,000 psi in the case of a 60x120-inch press). The air requirement for the cylinders varies from 30-50 to 60-120 psi, with 80 psi recommended. The presses are built by Union Tool Corporation in dimensions to meet users' needs.

What appears to be a handy gadget especially for stockrooms has been produced by Sorrell & Sons Company, Rocky River 16, Ohio. It's a pocket-size gauge for sorting nuts from No. 8 to ⅝-inch diameter, inclusive, and bolts and screws from No. 8 to ¾-inch diameter. The latter are gauged by pushing them through holes, while nuts are sized by dropping them over plugs on one edge of the horseshoe-shaped instrument. Besides giving the diameter of a nut, the plug gauge also indicates whether it has coarse (U.S.S.) or fine threads (S.A.E.). The device is 7¼ inches long and is said to be accurate to within 0.005-inch tolerance.

Fleets of trucks and buses kept outdoors in winter during hours of nonuse sometimes won't start because they are frozen. This can be obviated, says Vapor Heating Corporation, by its parking-lot heating system. The unit is housed in a portable 4x4-foot structure and circulates hot water through the vehicles by means of a pipe-line hookup. It takes a man about two minutes to make the three connections on a motor block by snap fittings provided for the purpose. Heater, forced-draft blower, and water and fuel pumps are all operated by a 1½-hp electric motor. When the temperature of the circulating water drops to 140°F, the heater is fired automatically and continues to function until the temperature of the water is 170°. Should some failure cause it to drop to 80°, an alarm bell sounds a warning, and a stack switch turns off the unit if the exhaust gases get too hot from lack of water in the system. One unit services up to 30 vehicles.

walls that walk...
WITH WAUKESHA POWER

Salem, Mass.—Erection of 12½-ton precast wall section at Sylvania Electric Co. plant by National Industrial Construction Co. of Palo Alto, Calif., using a Waukesha-powered 25-ton 190-T61 Bay City CraneMobile owned by Lee Crane Service, Inc., Boston, Mass.

In the Crane—
6-SRKR Waukesha—
six cylinders, 4⅛-in. bore x 5⅛-in. stroke, 517 cu. in. displ.

•

In the Truck—
145-GK Waukesha—
six cylinders, 5¼-in. bore x 6-in. stroke, 779 cu. in. displ.

• Picking up a section of concrete wall after it has been cast flat and, when it has set, tilting it up and setting it into place in the structure! That's how the contractor speeds construction with the 25-ton CraneMobile. It's precision handling, with precision power—Waukesha power!

And *Bay City* engineers-in that power with two Waukesha Engines—giving the contractor a balanced mechanical unit—a two-way combination of a versatile crane and a rugged mobile carrier.

The crane, with its independent power boom hoist, is powered with a 6-SRKR Waukesha for easy operation, the wanted line speed, and precision power load lowering. It handles heavy loads, high lifts and long reaches *dependably*—on even the hardest construction and erection jobs.

The truck carrier—with its 145-GK Waukesha Engine—has not only the power, but the speed and mobility for the job, and the reliable roadability to take it there.

Contractors' equipment is Waukesha-powered to pay profits—in performance dependability, in fuel economy, in low upkeep, in long life. Get Bulletins 1186 and 1124.

160

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN
NEW YORK TULSA LOS ANGELES

FIG. 1280A #4L

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√ More filtering area

√ More effective filtering

√ Choice of full flow or by pass filtering

√ Choice of inexpensive recharges

√ Simple piping

√ Capacities to meet every need

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Write today for descriptive literature outlining the nature of your filtering problems. It's the first important step towards big savings.

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417 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

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Books and Industrial Literature

Students in mechanical engineering and engineers engaged in production work, designing or tool engineering need a fundamental and up-to-date textbook dealing with materials, machine tools and processes adopted by industry. On that premise, Myron L. Begeman wrote *Manufacturing Processes*, which is now in its third edition, completely revised to cover new developments. Chapters such as those on special casting methods, welding and allied operations, cold forming of metals and plastic molding have been entirely rewritten. A new section includes continuous casting of metal, Marforming, hydrodynamic forming, plastic molds, multistation transfer machines, tracer-controlled machines, cold and stud welding, jigs and fixtures and many recent automatic and semiautomatic production machines. The first half of the 597-page book deals with foundry practices, patternwork, plastic molding, powder metallurgy, hot and cold working of metals, heat treatment and welding; the second half with measuring instruments, cutting tools, machines and their accessories. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Price, $6.00.

For services requiring ruggedness in combination with flexibility, Raybestos-Manhattan, Inc., Passaic, N. J., is offering its new Ray-Man "F" conveyor belt. It is fully described in Bulletin No. 6915 available upon request.

Gates Engineering Company, P. O. Box 1711, Wilmington, Del., has available upon request three 4-page folders briefly describing its protective Neoprene linings and coatings in liquid, sheet and other form for a wide range of industrial applications.

A quick reference folder, designated as Series F.L.B. 300-C, is obtainable from the Trico Fuse Mfg. Co., 2948 N. Fifth Street, Milwaukee 12, Wis. It covers its full line of fuses, shockproof fiber fuse pullers, clamps for fuse clips, test clamps and automatic oilers.

Sutton Tool Company, Sturgis, Mich., offers a new 8-page catalogue describing and showing installation and cross-sectional views of its Levermatic and Handmatic collet chucks for lathes of all makes and types. Copies are available from the company upon request.

Asphalt mastic flooring, a resilient topping for concrete, brick, wood and other surfaces made by The Tremco Manufacturing Company, 8701 Kinsman Road, Cleveland, Ohio, is discussed in *Mulsomastic Flooring*, an illustrated bulletin recently released by the firm and obtainable upon request.

For single or dual pressure operation on air, water or light oil from 0 to 150 psi, a new series of fast-cycling valves known as the Crescent Line has been developed by Barksdale Valves, 1566 E. Slauson Avenue, Los Angeles 1, Calif., and is described in Bulletin 1046C. Valves range in size from ¼ to ¾ inch.

Industrial concerns that have need of ultrasonic nondestructive testing but not enough to warrant purchasing instruments for the purpose, can now have the work done for them by Sperry Products, Inc. The latter will test metals and other materials

in the field or in its own laboratories. The field service entails day-to-day testing with a Reflectoscope or Reflectogage, or both, at the industrial plant by a company inspection engineer. The service is described in Bulletin 50-115 that can be obtained, along with price schedules, from W. C. Minton, service supervisor, Sperry Products, Inc., Danbury, Conn.

E. F. Houghton & Company, 303 W. Lehigh Avenue, Philadelphia 33, Pa., is distributing two 4-page folders. One deals with the physical properties and applications of its drawing compounds for every kind of drawing operation and the other helps users of its Cut-Max series of fortified and concentrated cutting fluids to select the one best suited for a specific purpose.

Bulletin 51B7225 lately issued by Allis-Chalmers Manufacturing Company, Milwaukee 1, Wis., is descriptive of its line of totally enclosed, fan-cooled motors for use in the presence of dust, fly ash, rain, snow or corrosive gases. It gives full construction details, ratings and dimensions of the Type APZ, which has no internal air passages and dirt-catching pockets.

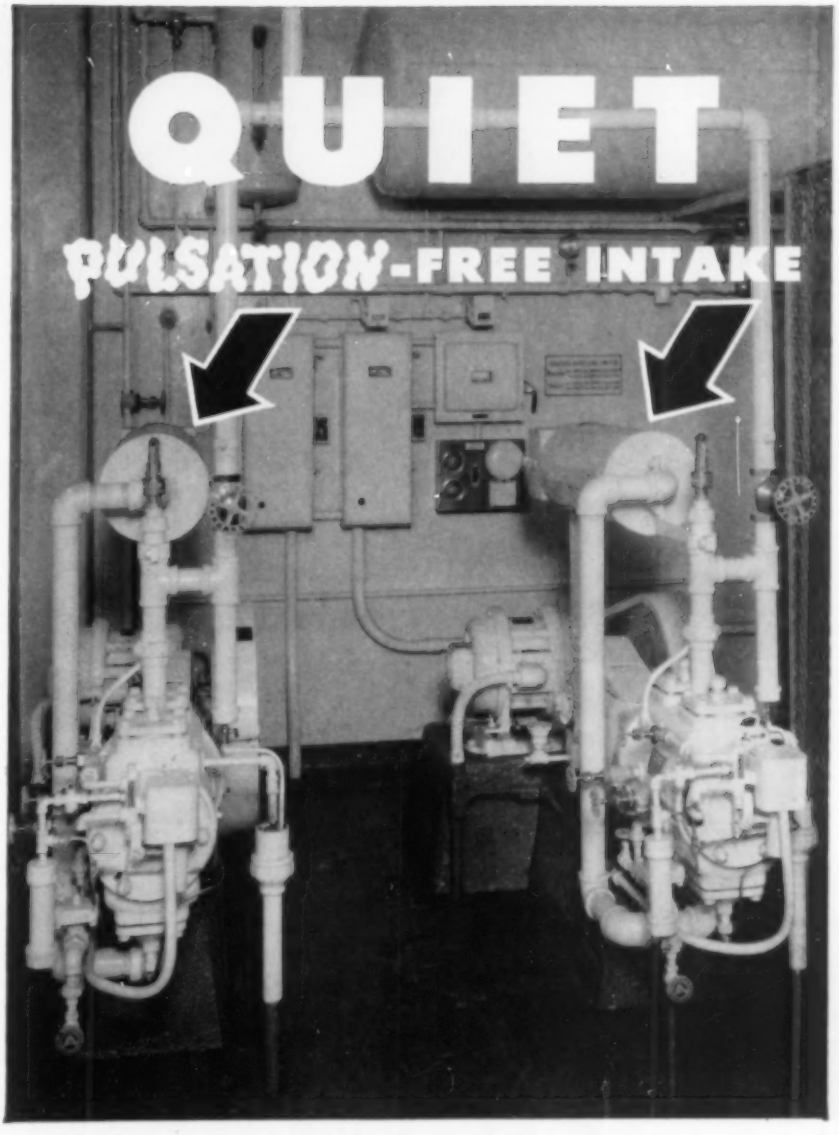
As an aid to designers and users of pneumatic and hydraulic mechanisms, Arrowhead Rubber Company, Downey, Calif., has prepared O-ring data sheets to be returned filled in with conditions under which O-rings are to operate and with other pertinent facts. Engineers of the company will study the problems presented and recommend solutions. Both the sheets and expert advice are free.

Those concerned with producing and maintaining temperatures as low as minus 165°F in mechanical freezers may find useful information in a new condensed specification bulletin issued by the Industrial Division of Webber Appliance Company, Inc., Indianapolis 3, Ind. It lists many standard models ranging in cold-chamber capacity from 4-cubic-foot testing and production units to production models with a capacity of 45 cubic feet.

If your work involves finish grinding of circular and flat-form tools, templates, profile cams, gauges, dies, etc., from hardened materials including tungsten carbide, or burring of external gears and multiple-start worms, you may find two new illustrated catalogues on the subject helpful. They are offered by The Sheffield Corporation, Dayton 1, Ohio. Ask for Micro-Form Grinders (MFG-122) and Gear Deburizer (B380).

New York Belting & Packing Company has published a new catalogue on conveyor and elevator belting which gives the necessary data to lay out a drive or to specify a belt. Tables on carrying capacities, horsepower factors, pulley diameters, maximum and minimum plies for proper troughing and other engineering information are included. A copy can be obtained from the company by addressing Frank E. Tilley, 1230 Avenue of the Americas, New York 20, N. Y., or from its distributors.

Safety valves are an essential feature of low-pressure equipment operating on gases or liquids throttled down from higher pressures and it is necessary to know their capacities if they are to give 100-percent protection in case of pressure-reducing-valve failure. Charts showing safety-valve capacities are contained in a new bulletin (No. 851) recently released by Marine & Industrial Products Company, 3731 Filbert Street, Philadelphia 4, Pa. Also included is a gas volume-weight chart for determining vol-



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● Maxim makes silencers for compressor intake, vacuum pump discharge, blower intake or discharge, internal combustion engine exhaust or intake, high velocity steam, air or gas discharges, spark arresting and heat recovery silencers.

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4MX52

How NAYLOR gives you EXTRA SAFETY in Light-weight Pipe

This simple sketch gives you the inside story on the extra safety built into every section of Naylor light-weight pipe. The arrow points to the "heel" which extends the entire length of the pipe in spiral form. This acts as a continuous expansion joint absorbing shock loads, vibration, expansion and contraction stresses and strains which are so often destructive to welds on a rigid structure. No other light-weight pipe can match this performance. That's why so many engineers depend on Naylor Pipe in mining service. Write for Bulletin No. 507.

NAYLOR PIPE

Naylor Pipe Company
1245 E. 92nd St., Chicago 19, Ill.
New York Office:
350 Madison Ave., New York 17, N.Y.

umes per pound of gases with varying specific gravities at different pressures and temperatures. The bulletin is obtainable upon request written on company letterhead indicating position of the addresser.

A 56-page book, titled *Production Control Systems and Procedures*, has been prepared for executives by Remington Rand Inc., 315 Fourth Avenue, New York 10, N. Y. It outlines complete procedures for engineering, production planning and progress, machine load, material and tool procurement and control and is fully illustrated with typical forms and charts. Included is a case history of an installation that has been in operation for several years. Ask for your free copy of Publication X-1268.

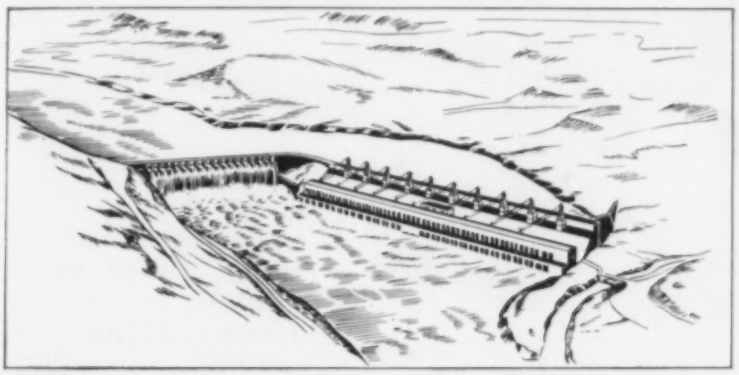
Vacu-Blast Company, Inc., has issued a new catalogue covering uses of its movable Vacu-Blaster for cleaning metal, concrete, brick, stone and wood surfaces. It contains numerous drawings and action photographs, deals with difficult cleaning jobs, enters into the operating details of the generator-reclaimer and dust collector which are features of the machine, and lists accessory equipment. A copy of the 20-page booklet, called *Vacu-Blaster*, can be obtained from the company at 350 Peninsular Avenue, San Mateo, Calif.

With radioactive materials in appreciable use in hospitals and laboratories, on civil-defense projects, and in industry as tracer constituents, General Electric's illustrated booklet on radiation instruments, GEA-5735, should prove of broad interest. It covers the company's radiation monitor, scintillation counter, portable radiation probe, area health monitor, long-probe gamma survey meter, alpha hand counter, air equivalent ionization chamber, boron-coated counter tube, thermocouple vacuum gauge, and the step-motor impulse counter. The booklet can be obtained from A. B. Berry, General Electric Company, Schenectady 5, N. Y.

A new 44-page booklet on the fusion welding of nickel and high-nickel alloys has been published by The International Nickel Company, Inc. It includes more than 30 tables and many drawings and photographic illustrations. A complete technical treatise on the subject, it covers various forms of electric-arc and gas welding. There are more than twenty chapters and sections covering, in addition to detailed welding instructions, such information as the boiler code of the American Society of Mechanical Engineers; pickling, testing and inspection safety methods, and associated topics. Technical Bulletin T-2 is obtainable without charge through the Technical Service Section of The International Nickel Company, 67 Wall Street, New York 5, N. Y.

Compressed Air Power in Construction is the second of a series of classroom reference pamphlets being released for free distribution by the Compressed Air and Gas Institute, 1410 Terminal Tower, Cleveland 13, Ohio. Prepared by its Committee on Engineering Education, the 21-page illustrated publication discusses the many uses of compressed air in the construction field and the tools required for such operations as digging, drilling, hoisting, pile driving, bolting, riveting, tamping, sawing, spraying paint and cement, vibrating concrete, pumping and conveying. It also explains how the equipment works and gives methods for measuring its performance. Several pages are devoted to compressors and air distribution systems. Tables recommending pipe and hose sizes for air at varying pressures are included.

Wagon drills at work high above the north bank of the Columbia River. This impervious glacial till was blasted loose and used in sealing the right bank upstream from the axis of the dam. This contract was held by Peter Kiewit Sons Company.



The powerhouse at Chief Joseph Dam will ultimately house 27 generating units and will be more than 2,000 ft long, making it the longest powerhouse in the world. The project is under the direction of Corps of Engineers, U. S. Army, Seattle District.

This rock mound, under attack by a battery of busy wagon drills using Bethlehem Hollow Drill Steel, was cleared away for the intake channel to the powerhouse. General Construction Company of Seattle held this contract.

Chief Joseph Dam on Columbia River to be Second Largest Power Producer

Chief Joseph Dam will be the second largest hydroelectric power plant in the world, having an ultimate generating capacity of 1,728,000 kw. Now under construction on the Columbia River in Washington, this concrete, gravity-type structure will back up a reservoir reaching 51 miles upstream to the tailrace of Grand Coulee Dam.

The dam, named for the Nez Perce chieftain of 19th Century fame, is scheduled to begin operation in 1955. It is to be 2,260 ft long and 220 ft high. Construction will require the excavation of about 5,500,000 cu yd of rock.

That's a lot of rock, and it calls for good drill steel, steel that can be depended on to keep the drilling on schedule. Right now there is more than 100 tons of Bethlehem Hollow Drill Steel at work at the site of this big dam.

Chief Joseph Dam is the latest addition to the long list of notable jobs on which this "old reliable" of drill steels is playing a big part.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

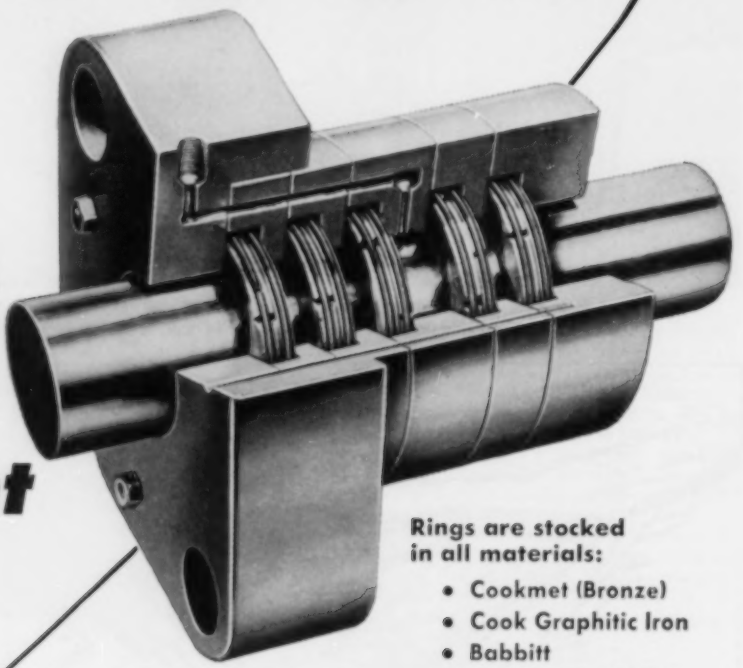
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

★ BETHLEHEM STEEL ★

BETHLEHEM HOLLOW DRILL STEEL

CALL COOK

. . . for fast service on packing replacement parts!



Rings are stocked in all materials:

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- Cook Graphitic Iron
- Babbitt
- Cookroc (Bakelite)

WHEN WEARING RINGS REQUIRE REPLACEMENT, you generally need them in a hurry. That's why it will pay you to call COOK whenever the occasion arises. Our warehouses are located at strategic points throughout the country and are stocked and ready to give your orders fast efficient attention. Emergency shipments Bronze, Cook Graphitic Iron, Babbitt or Cookroc (bakelite) rings can usually be made within a few hours time. So, don't take chances with substitutes . . . always insist on genuine COOK packing parts. You'll get them just as fast as they can possibly be delivered.

C. Lee Cook Mfg. Co., Incorporated, Louisville, Ky. Branch offices in Baltimore, Boston, Chicago, Cleveland, Houston, Los Angeles, Mobile, New Orleans, New York, San Francisco and Tulsa.

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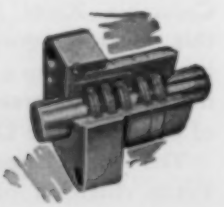
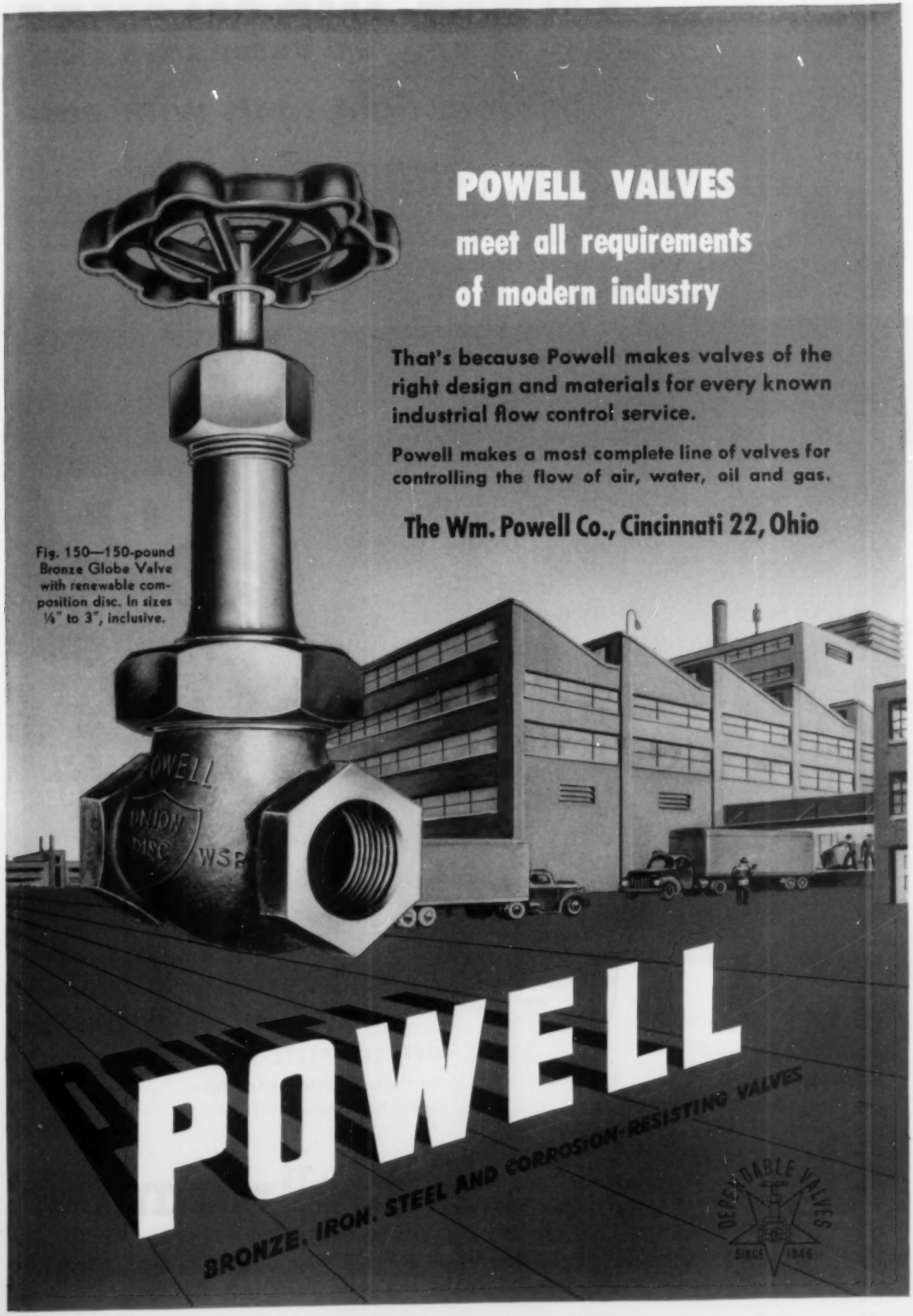
ROD PACKINGS



. . . SEALING PRESSURES SINCE 1888 . . .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meet all requirements
of modern industry
That's because Powell makes valves of the right design and materials for every known industrial flow control service.
Powell makes a most complete line of valves for controlling the flow of air, water, oil and gas.
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Fig. 150—150-pound Bronze Globe Valve with renewable composition disc. In sizes ⅛" to 3", inclusive.
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BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES
DEPENDABLE VALVES
SINCE 1846

Ingersoll-Rand ANGLE WRENCHES

get into tight spots with ease

FOR NUT-RUNNING JOBS UP TO ¾" BOLT SIZE! I-R Angle Wrenches are amazingly powerful Air Tools, light in weight for easy handling. These handy air-operated Angle Wrenches are designed solely for fast nut running in confined locations where the use of other types of nut runners is impossible.

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STALL TORQUE
1.8 to 83 ft. lbs.
(at 90 psi air pressure)

HEIGHT OF ANGLE HEAD
1-3/16" to
3-11/16"

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Angle Wrenches Licked This Tough One!

A really mean close-quarter job on an automotive assembly line took its toll of 12 angle wrenches in 1 week's time—An Ingersoll-Rand air powered Size 18L was put on this job and gave uninterrupted production for 3 months.

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Louis Allis explosion-proof motors have the Underwriters' Laboratories approved labels for all types of hazardous conditions—Class I, Group D for explosive liquids and vapors; Class II, Group G for combustible dust; Class II, Group F for carbon black, coal and coke dust; Class II, Group E for combustible metal dust.

There is a modern streamlined Louis Allis Explosion-Proof motor to satisfy your most exacting specifications. A careful comparison and analysis will show you that Louis Allis Explosion-Proof motors offer you more dependable performance, convenience, long life and safety.

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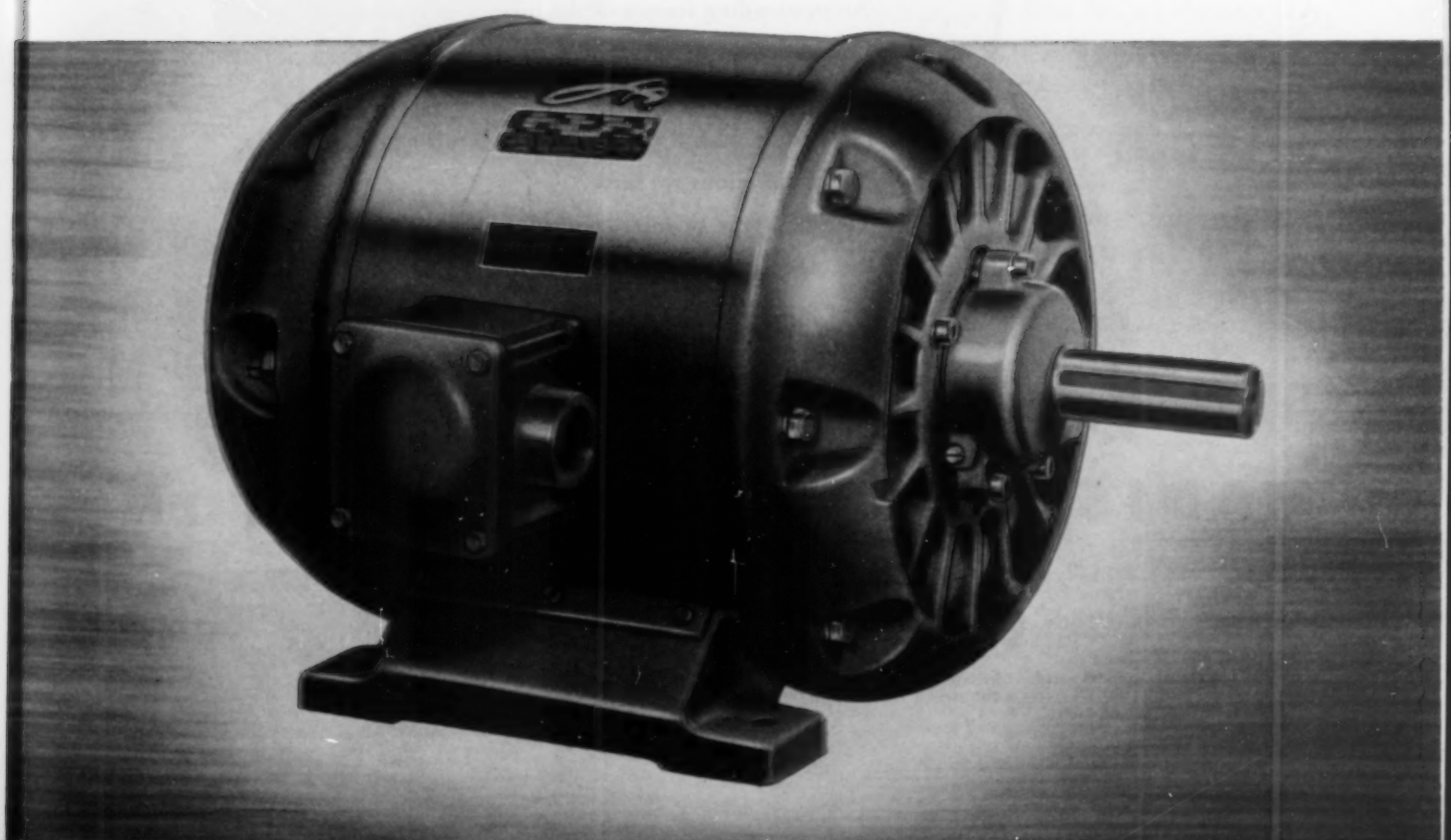
THE LOUIS ALLIS CO., Milwaukee 7, Wis.



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An outstanding feature of the history of Madison-Kipp is the consistency of its services to the same customers year after year for 10, 20, 30 or more.

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ANCIENS ATELIERS GASQUY, 31 Rue du Marais, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS

TEAMWORK IN SPECIALTIES

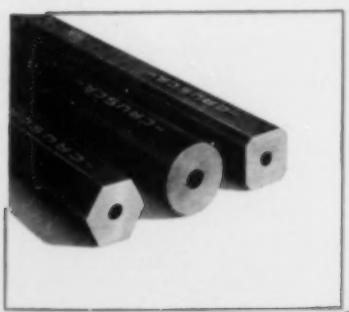
the drill runner...

CRUCIBLE HOLLOW DRILL STEEL

The drill runner is a busy guy—continuous boring through hard rock with high-speed drills. His job efficiency is dependent not only on his skill... but on the tools he uses. That's why in almost all drilling operations you'll find Crucible Hollow Drill Steel the number one choice.

This quality steel is built to take the punishment of around-the-clock operation of modern, high air-pressure rock drills. And you have the assurance of minimum breakage . . . and an end to expensive bit loss. That's because Crucible Hollow Drill Steel is backed by the experience of specialty steelmakers.

Insure the quality of your job—cut costs—use Crucible Hollow Drill Steel.



CRUCIBLE first name in special purpose steels

52 years of Fine steelmaking

HOLLOW DRILL STEEL

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

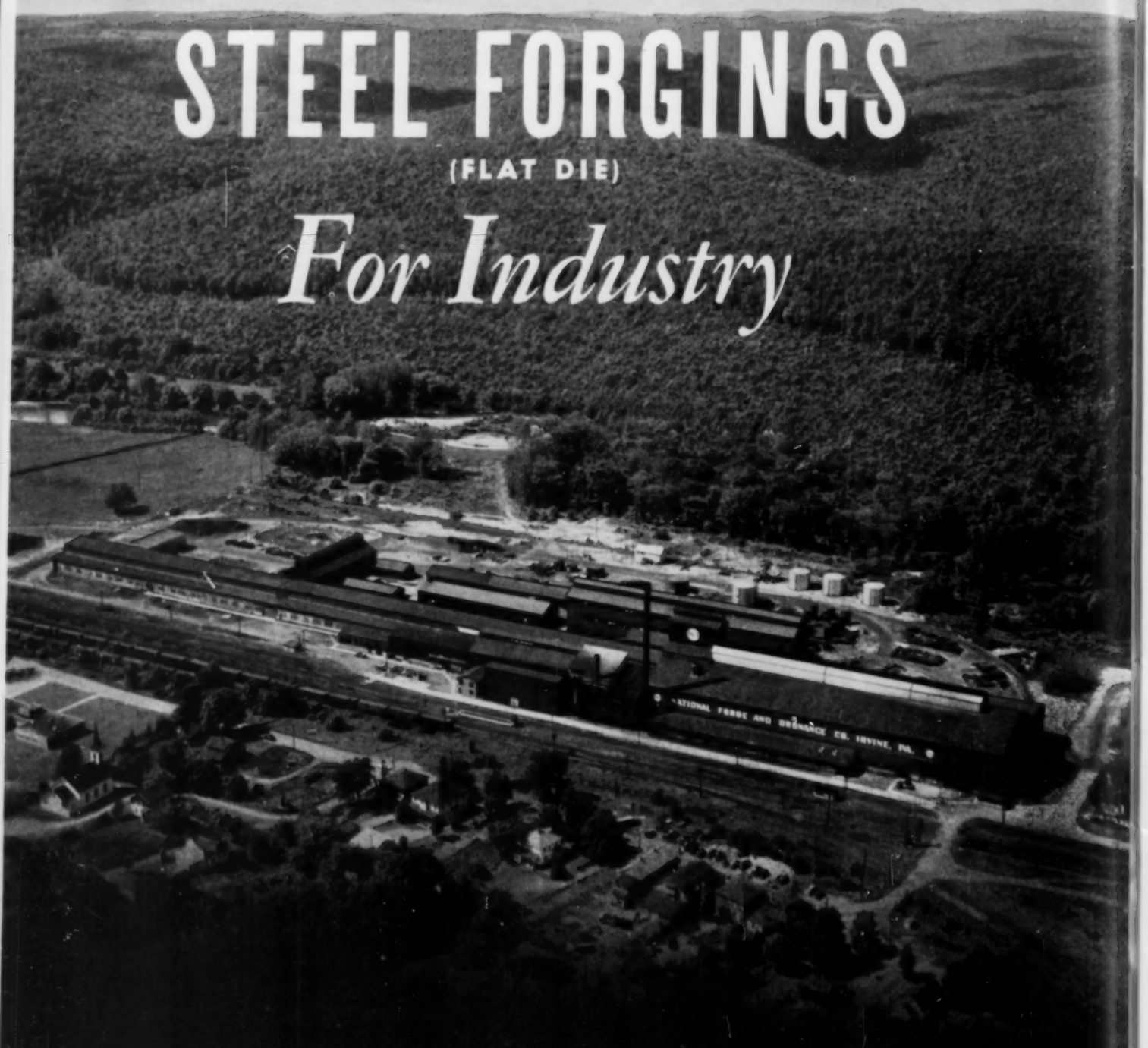
REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

Steel Makers • Forgesmiths • Heat Treaters • Machinists • Testing Equipment & Machinery Manufacturers

STEEL FORGINGS

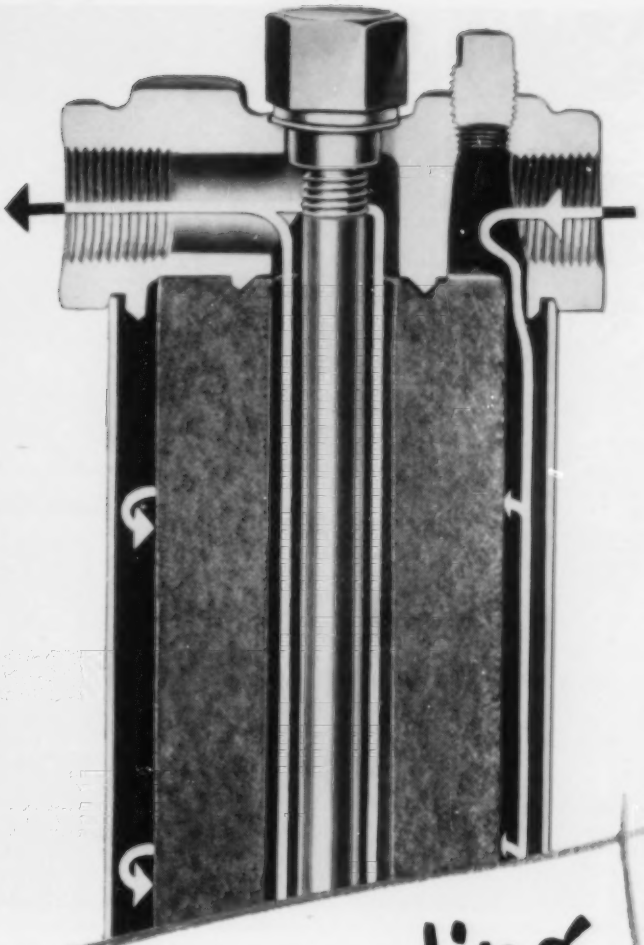
(FLAT DIE)

For Industry



NATIONAL FORGE AND ORDNANCE COMPANY

IRVINE, WARREN COUNTY, PENNSYLVANIA



No Channeling with this micronic filter

Won't shrink, won't swell. Won't harden, won't soften. Won't distort in any way. That's Cuno MICRO-KLEAN . . . the filter that outlasts any other replaceable-cartridge filter 2 to 1!

Get Dry, Clean Air the Positive Way

Entrained moisture and dirt in compressed air just don't *find* a way to get through a Cuno MICRO-KLEAN Air Line Filter.

As the cutaway shows, the air entering the filter first encounters a baffle (A) which deflects some moisture down outside the cartridge.

Then the air is forced into the porous fibre structure of the cartridge (B), being required to make many sharp turns through ever-narrowing passages, impinging eventually on the fibres.

The moisture promptly drains off these non-wicking fibres into the large collection chamber (C).

Fewer Cartridge Changes

There's more room for dirt in the MICRO-KLEAN cartridge . . . meaning you need to change it less often—*half* as often.

That's because its exclusive construction—"graded density in depth"—reduces surface loading and permits smaller particles to penetrate to varying depths.

Pressure drop across the cartridge is slight due to the openness of the structure—80-90% porosity—and to the absence of purely structural components (none needed) that offer resistance to flow.

Test Cuno MICRO-KLEAN Air Line Filters on your equipment—pneumatic tools, air-operated instruments, spray systems, etc.—and be *sure* of dry, clean air.

CUNO

Fluid Conditioning

Removes More Sizes of Solids from More Kinds of Fluids

Strain fuels, lubricants, process fluids, etc.—AUTO-KLEAN
Filter fuels, lubricants, process fluids, etc.—MICRO-KLEAN
Clean raw water, recirculating water, etc.—FLO-KLEAN

Cuno Engineering Corporation
Dept. 178D South Vine Street, Meriden, Conn.

Please send information on Cuno MICRO-KLEAN Air Line Filters for.....
(mention application)

Name.....Title.....

Company.....

Address.....

City.....Zone....State.....

Please attach to business letterhead

Quality Clutches Exclusively

The policy of Industrial Clutch Corporation since its inception 21 years ago has constantly been to design and build only the best clutches that engineering experience and a skilled group of workmen could produce, and to price such clutches as low as was consistent with high quality. We have steadily refused to sacrifice quality for the sake of a low price and, therefore, our product and services appeal primarily to those discriminating clutch users who appreciate superior quality.

Our modern plant is directed by clutch engineers and equipped with a full complement of precision machine tools, jigs and fixtures for producing clutches of the highest quality in any required quantity.

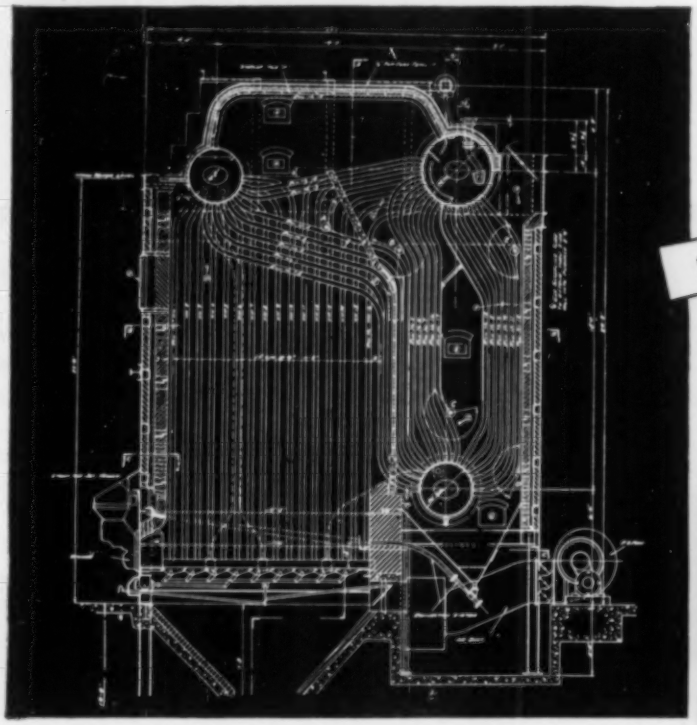
We have a standard line of Flex-Disc Clutches, in both spring loaded and over-center types, ranging in sizes from 8" to 35" diameter—also air operated "Flex-Disc" clutches in a complete range of sizes for punch press and similar applications. Special clutches are designed and built for operating requirements that can not be met by commercially available mass production clutches.

Inquiries for either "standard" or special types of clutches will receive prompt attention. Our engineering service on clutch problems is available without obligation.

INDUSTRIAL CLUTCH CORPORATION

Waukesha Wisconsin

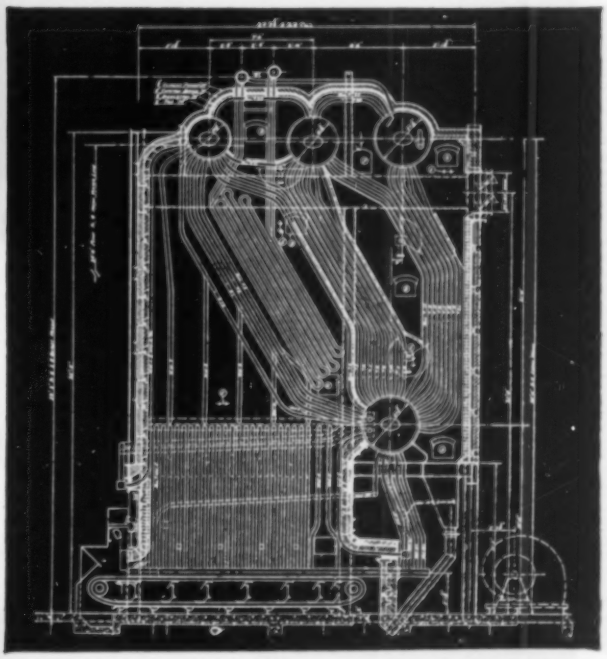
Quick Steaming at all Ratings!



Carry high overloads with high efficiency

SPECIFY **Vogt**

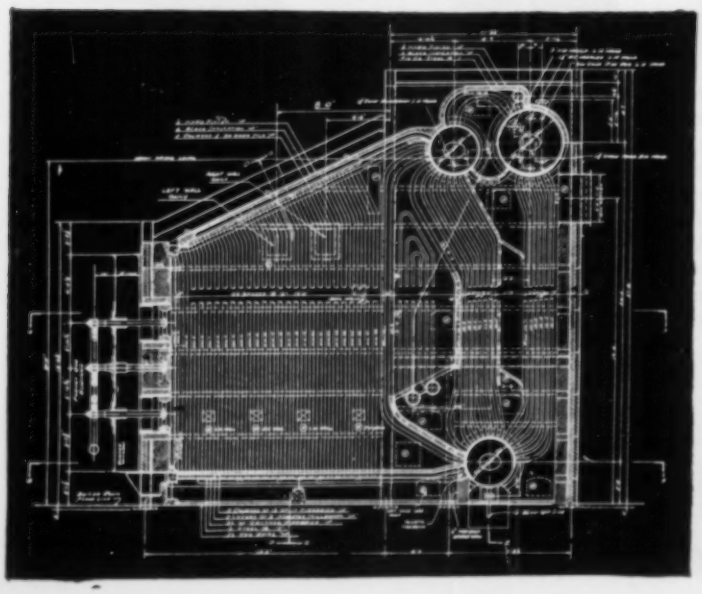
STEAM GENERATING UNITS



CLASS VL Two 27,500 pounds per hour units, installed at Brown-Forman Distillers Corporation, Louisville, Ky. Features large furnace volume in limited space, with high ratio of radiant heating surface.

CLASS LE Mt. Carmel Public Utility, Mt. Carmel, Illinois, is served by this 60,000 pounds per hour unit. Generous steam liberating surfaces and steam space permit wide fluctuations in load.

CLASS VR 70,000 pounds per hour steam generator at Humble Oil and Refining Company, Johnsue, Texas. An efficient, high-duty unit with water cooled furnace, using refinery gas fuel.



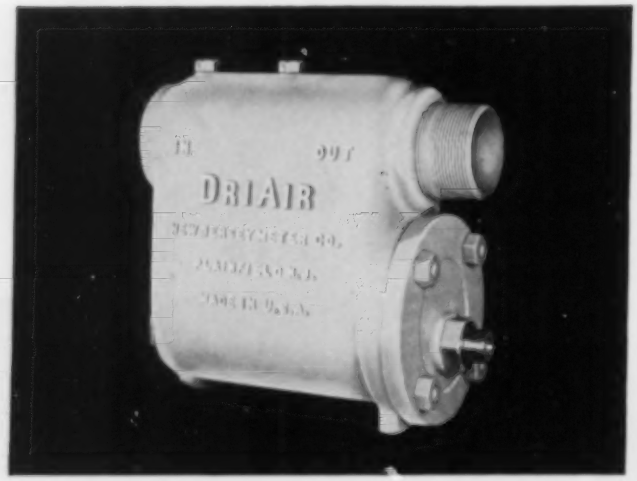
Vogt builds a complete line of bent tube steam generators, designed to burn solid, liquid, or gaseous fuels to meet specific operating conditions. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Bulletins with general information and showing typical installations are available upon request.

HENRY VOGT MACHINE CO.

LOUISVILLE 10, KENTUCKY

BRANCH OFFICES:
NEW YORK, PHILADELPHIA, CLEVELAND
CHICAGO, ST. LOUIS, DALLAS

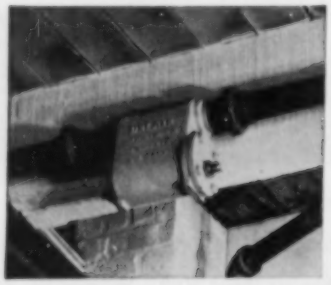
DEPENDABLE PNEUMATIC SERVICE



WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected.

DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

NEW JERSEY METER COMPANY

PLAINFIELD, NEW JERSEY

THE SARCO TR-40 COOLING CONTROL

Maintains constant temperature of cooling water in compressors, condensers, degreasers, furnace doors and other water cooled equipment.

The TR-40 saves water because only enough can pass the valve to hold the temperature desired. It increases efficiency by maintaining correct jacket temperatures.

Available in sizes ⅜" to 1". Calibrated for any temperature between 40 and 200 degrees F. Ask for Catalog No. 700.

299

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

ALL ABOUT AIR TRAPS

SEND FOR THIS NEW BULLETIN

AIR trap selection and installation for automatic drainage of water from compressed air intercoolers, aftercoolers, receivers, separators and drip points are fully described. Helpful sections include typical installation diagrams, illustrations of the various models of Armstrong Air Traps, their applications and operation, and their materials (cast or forged steel bodies and caps, chrome steel valves and seats, stainless steel interior parts). Physical data and list prices complete the story.

There's enough information here for anyone to make the most effective air trap selection for *any* moisture drainage job, any pressure or capacity range. FOR YOUR COPY, WRITE:

ARMSTRONG MACHINE WORKS
885 Maple Street · Three Rivers, Michigan

DO YOU USE V-DRIVES?

. . . if so, get FREE Catalog

Yes, this 96 page book is practically a "treatise" on the subject of V-Belt Drives, their selection and application.

Write for copy of same, but please do so on your *Business Letterhead.*

Wood's also make: Flat Belt Pulleys, Hangers, Pillow Blocks, Bearings, Couplings, etc. . . . *nearly a Century of Mechanical Power Transmission Experience is behind Wood's.*

T. B. WOOD'S SONS CO.

CHAMBERSBURG, PA.

Boston, Mass. ● Newark, N. J. ● Dallas, Texas ● Cleveland, Ohio

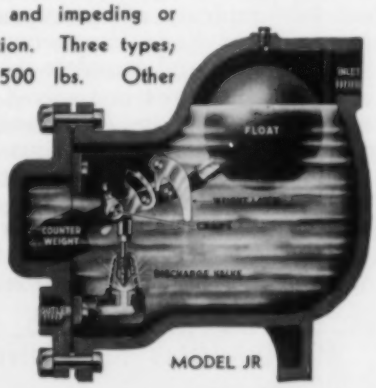
---

Ne **NICHOLSON**

NON-PLUG AIR TRAPS

Introduce Oil-Eliminating Feature Preventing Build-up of Scum and Sludge

In these Nicholson air traps you enjoy the advantages of the positive intermittent action of a float-operated air trap without the common problem of oil congealing on the mechanism and impeding or stopping its action. Three types; pressures to 1500 lbs. Other features: No air - wasting vent. Positive water seal at valve. Large orifice keeps valve clean. For details send for . . .



Bulletin 651

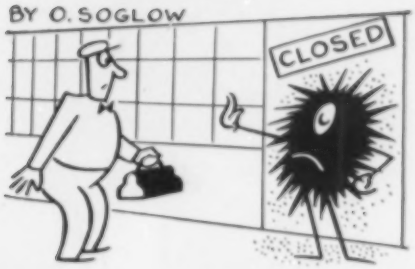
180 OREGON ST., WILKES-BARRE, PA.

W. H. NICHOLSON & CO.

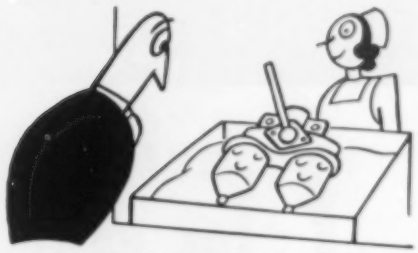
TRAPS · VALVES · FLOATS

AIR-MAZING FACTS

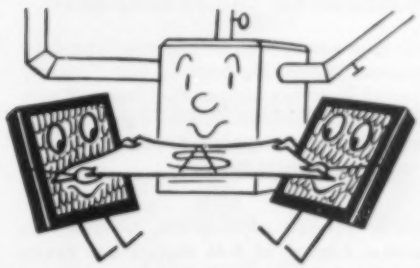
BY O. SOGLOW



ATOM DUST CLOSES PHOTO PLANT! Radioactive dust from an atomic explosion in Nevada, carried cross-country by air currents to a Rochester, N. Y., photo film factory, "exposed" and ruined a large amount of stored film there, causing the plant to shut down for 36 hours.



IT'S TWINS! No need for shutting down production when oil line filters need cleaning. With a new Air-Maze duplex oil filter on the job you can clean one "twin" at a time, while oil continues to flow through the other.



DUSTAY® STRETCHES FUEL DOLLARS! Dirt-clogged filters in your furnace block off air, make your furnace work overtime and use more fuel. Stretch your fuel dollar by replacing dirty filters with new Dustays—the disposable filters that hold more dirt without clogging.

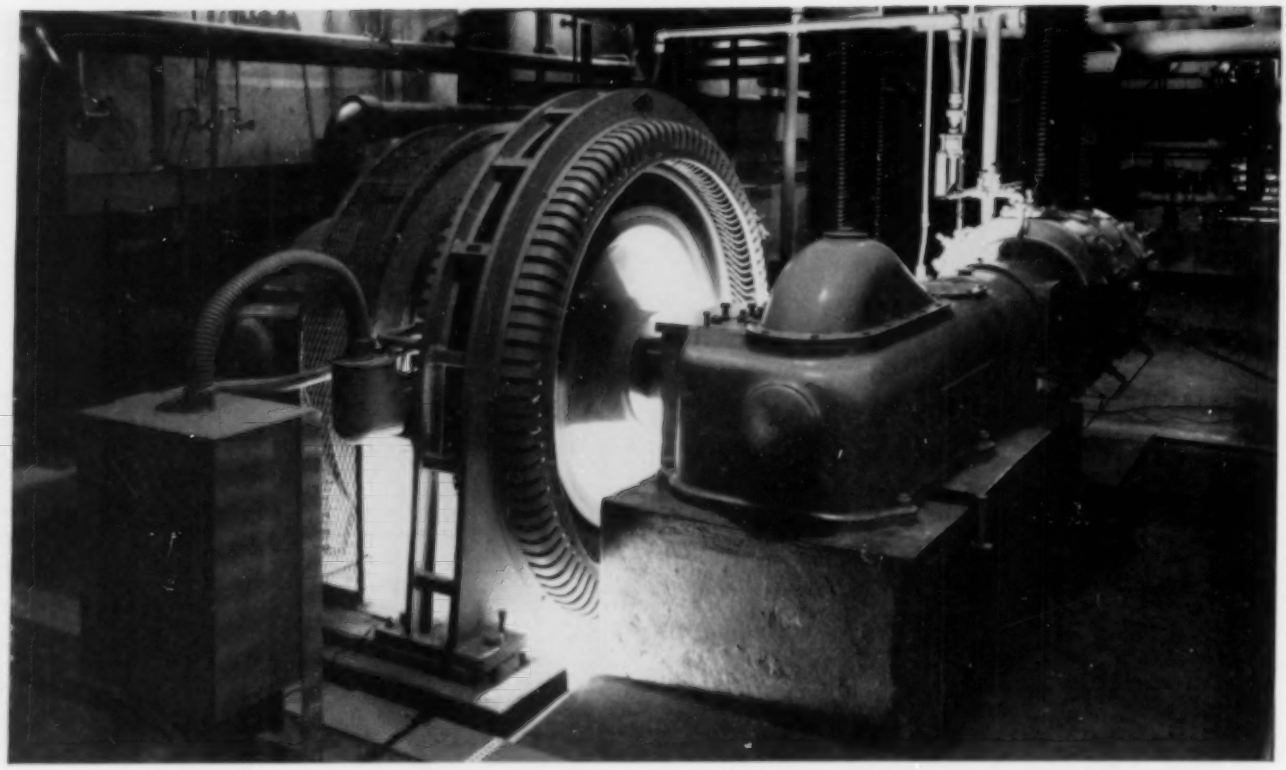
WHETHER YOU BUILD OR USE engines, compressors, air-conditioning and ventilating equipment, or *any device using air or liquids* —the chances are there is an Air-Maze filter *engineered* to serve you better. Representatives in all principal cities, or write Air-Maze Corporation, Cleveland 5, Ohio.

AIR-MAZE

The Filter Engineers

AIR FILTERS
SILENCERS
SPARK ARRESTERS

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS



Here's the Perfect Partner for your Large Compressor

E-M

Advantages for you to remember:

1. You save money with E-M Engine-Type Synchronous Motors. No belts to buy . . . and space-saving direct mounting on the crankshaft puts installation cost at minimum. Full-voltage starting is economical. Soundly engineered, efficient design gives you lowest operating cost.

2. You're assured of long-life, trouble-free service. Frames of E-M Motors are heavy deep-section fabricated steel, reinforced and welded into a single unit. Wide rotor spokes have high torsional strength, and field poles are securely anchored with a liberal safety factor.

3. You can profit in performance and save in costs by contacting E-M early on compressor drive problems. For reliable, efficient service, E-M Engine-Type Synchronous Motors and Polarized Field Frequency Control are recognized as the *best* for any large compressor operation.

E-M Engine-Type Synchronous Motors are made-to-order for compressor drives

● Linked hand in hand for dependable production at Parke, Davis & Company in Detroit (above) are the reciprocating air compressor and its most important working partner . . . an E-M Engine-Type Synchronous Motor.

The advantages you get in economical operation, space-saving installation and low maintenance costs have made E-M Engine-Type Synchronous Motors "perfect partners" for large reciprocating compressors.

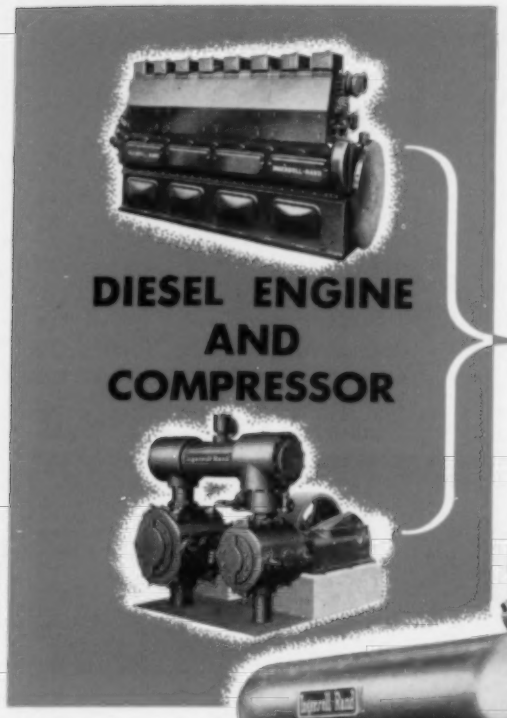
This closely matched association of compressor and motor offers you significant benefits. These direct-connected motors, having only a stator and rotor, give you unbeatable simplicity, efficiency and low cost service. The E-M Polarized Field Frequency Control insures perfect synchronizing and complete motor protection.

E-M engineers have met and solved compressor drive problems for nearly 40 years. As a result, they can design each E-M Engine-Type Synchronous Motor to match exactly specific compressor operating characteristics. Be sure to check E-M before you specify your next large compressor installation. Contact your E-M field engineer, or write the factory for E-M's 24-page booklet on Air Compressors . . . ask for Synchronizer No. 32.

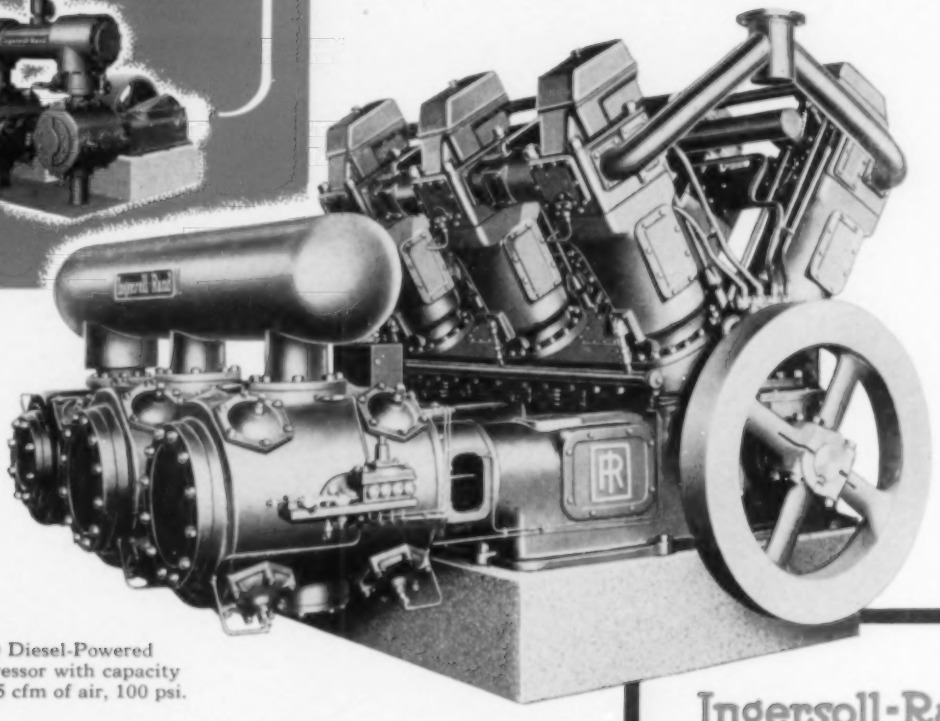
ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

1200-TPA-2098

E-M SYNCHRONOUS MOTORS AND CONTROLS FOR LARGE COMPRESSOR DRIVES



...IN ONE UNIT



6XVO Diesel-Powered Compressor with capacity of 1075 cfm of air, 100 psi.

The XVO diesel-powered compressor is a completely self-contained compressor plant. It provides a dependable compressor that's entirely independent of local power sources. And it assures maximum economy of installation, operation and maintenance.

The XVO is more than just a compressor driven by a diesel engine. It's compressor and engine *all in one*. The 4-cycle diesel power cylinders and double-acting compressor cylinders are mounted in a single, compact frame. The pistons in both the power and compressor cylinders are connected to the same crankshaft. This space-saving unit design results in exceptionally high efficiency—permitting the XVO to compress 5600 cubic feet of air to 100 psi with *one gallon* of fuel.

Ingersoll-Rand XVO compressors are available with 2, 4, 6 and 8 power cylinders, for capacities of 335, 700, 1075 and 1450 cfm respectively (100 psi air). Compressor cylinders for any pressure or vacuum can be furnished.

For further information, see your nearest I-R representative. Or write for your free copy of Bulletin No. 3172-A.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO-BLOWERS
CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

Ingersoll-Rand

XVO

Diesel-Powered Compressors

- *Save Space*
- *Save Weight*
- *Save Fuel*
- *Make Compressor independent of local power source*

727-6

More air—less care with help of TIMKEN® bearings

PROVIDING air for this impact wrench is just one of many jobs done by this Ingersoll-Rand air compressor. To keep the compressor in top operating condition—ready to provide a dependable source of air whenever it's needed—Ingersoll-Rand mounts compressor crankshafts on Timken® tapered roller bearings.

Because of their tapered construction, Timken bearings take radial and thrust loads in any combination—hold shafts in rigid, positive alignment.

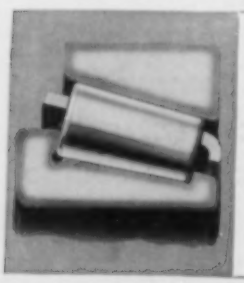
Timken bearings keep housing and shaft concentric, make closures more effective. Lubricant stays in, reducing maintenance. Dirt stays out, reducing wear.

Because they're engineered for the job, precision manufactured and made of Timken fine alloy steel, Timken bearings normally last the life of the machine in which they're used.

No other bearing can give you all the advantages of Timken bearings. Make sure you have them in the machines you buy or build. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

How **INGERSOLL-RAND** mounts compressor crankshafts on Timken bearings to assure long life and minimum maintenance.



GREATER LOAD AREA

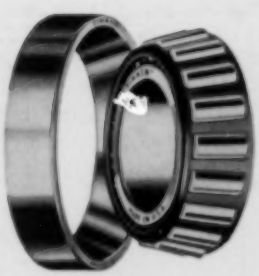
Because the load is carried on the *line* of contact between rollers and races, Timken bearings carry greater loads, hold shafts in line, wear longer.

The Timken Roller Bearing Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION